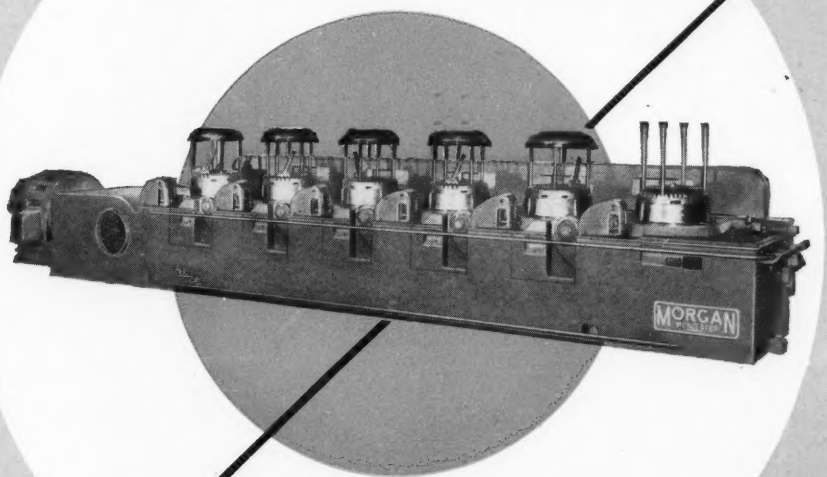
WIRE AND WIRE PRODUCTS

JUNE 1956

FOR TOP PRODUCTION...

AT LOWER COST...



HIT THE MARK

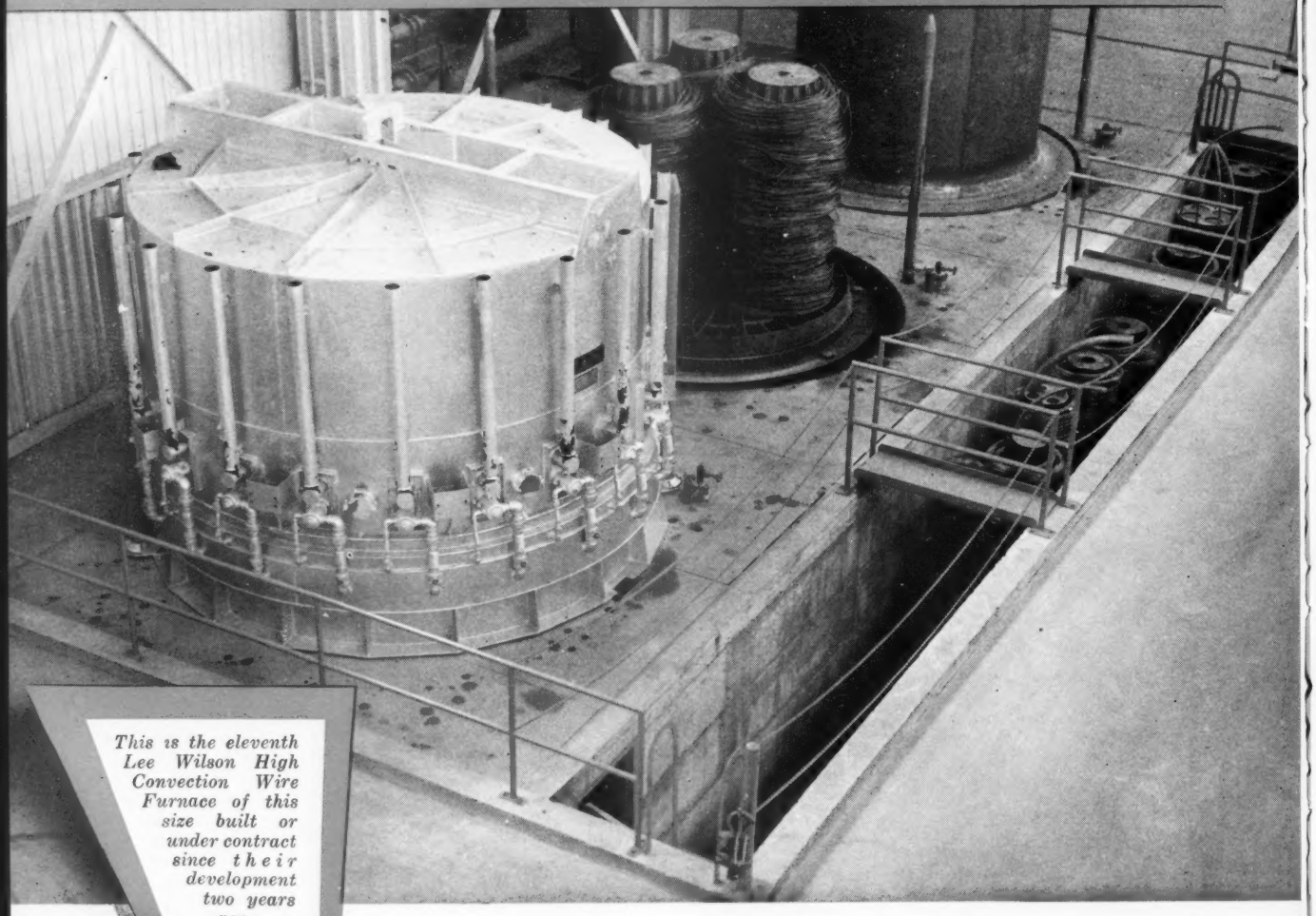
WITH MORGAN-CONNOR

WIRE DRAWING MACHINES

MORGAN CONSTRUCTION COMPANY • Worcester, Mass.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

The newest thing in Wire Annealing



This is the eleventh Lee Wilson High Convection Wire Furnace of this size built or under contract since their development two years ago.

. . . The Lee Wilson High Convection Furnace!

THE Lee Wilson High Convection wire annealing equipment is offering the wire industry a new tool for better quality and higher yield at lower equipment cost per ton.

To meet the demands of ever-increasing size of production orders, the Lee Wilson 108" charge diameter furnace permits fast, uniform annealing of three stems of rods per charge — and up to 36,000-pound loads of drawn wire.

The extraordinarily high 5,000,000 Btu./hr. fuel input is put to efficient work by an exclusive circulating system that moves the gases under the inner cover at a rate of more than five times that of older style designs. The 25' HP fan drive motor moves the gases under the inner cover more than 25,000 cfm.

Lee Wilson* ENGINEERING COMPANY, INC.
20005 WEST LAKE ROAD • CLEVELAND 16, OHIO

HIGH CONVECTION ANNEALING FURNACES
MAKE THE BEST METALS BETTER

10024

*ORIGINATORS AND LEADING PRODUCERS OF HIGH CONVECTION ANNEALING FURNACES

"America's Finest
Wire Drawing Lubricants"

Presenting:

S. I.

SERVICE INCOMPARABLE
SALES INTEGRITY
SOAPS IMPERIAL

>>> NEW <<<

8633
8650
OUR NEWEST APPROACH TO A BETTER COLD HEADING LUBRICANT

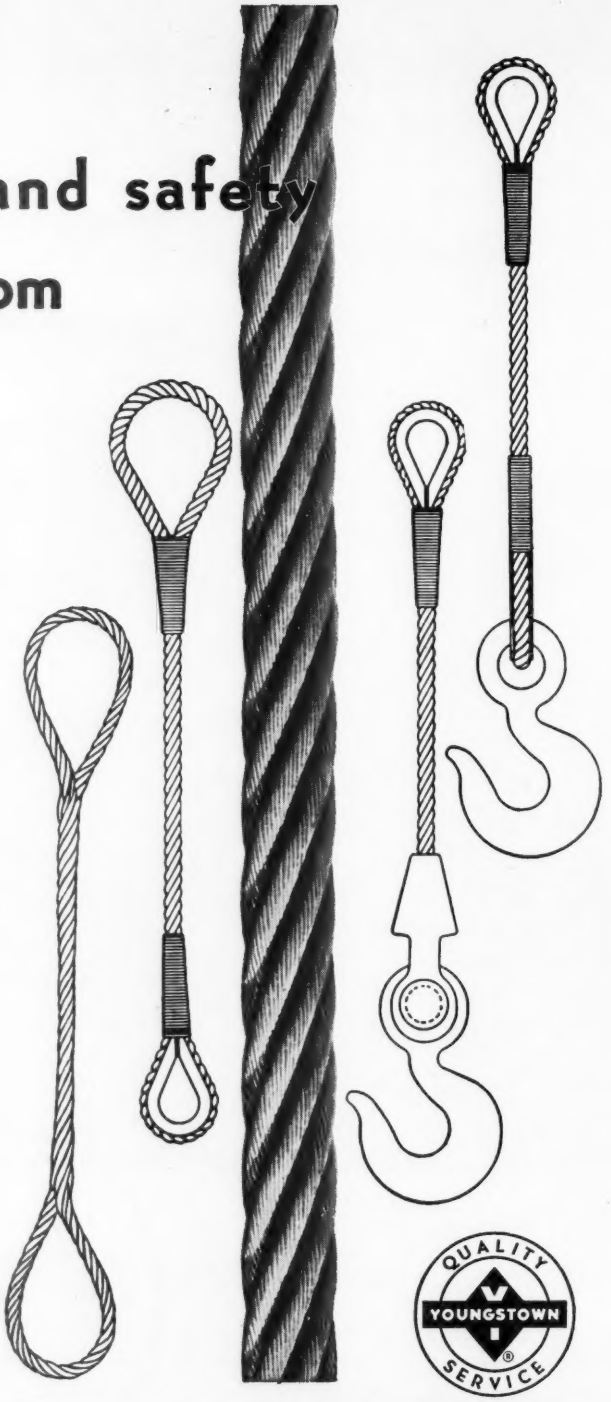
Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

54Q
THE LATEST & FINEST MILL TESTED & APPROVED LUBRICANT FOR MECHANICALLY DESCALED RODS & WIRE

NO.
55
PROBABLY THE FINEST GENERAL PURPOSE LUBRICANT AVAILABLE

Standard Industrial COMPOUNDS CO., INC.
FRANKFORT, ILLINOIS
(A suburban Chicago area city)
TELEPHONES: 2131 — 2141

Where strength and safety count, rope wire from Youngstown does the job!



Long experience in the manufacture of wire rope and rope fittings has taught Upson-Walton all the ins-and-outs of this business. Theirs are quality products, long noted for strength and safety. And, these qualities of strength and safety become inherent in Upson-Walton products with the selection of the basic material: Youngstown Yolectro Rope Wire.

For, Youngstown offers the most vital requirement of wire for wire rope—that of uniformity. Controlled and painstaking steel processing are the reasons why; extra strong and flexible rope wire, easy to form and yet tough enough to meet the approval of the most critical rope manufacturers and users is the result.

Youngstown Bright and Galvanized Yolectro High Carbon Rope Wire is furnished in all AISI grade designations. Phone or write our nearest District Sales Office.

QUALITY YOUNGSTOWN SERVICE

Youngstown YOLECTRO HIGH CARBON ROPE WIRE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

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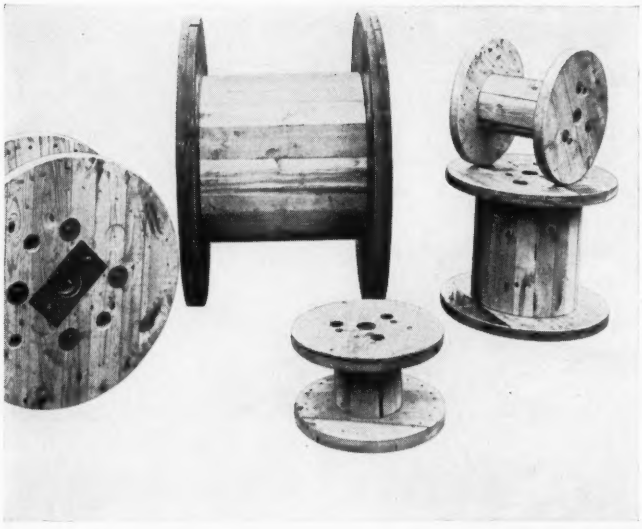
SAVE with..
NON-RETURNABLE
WOOD shipping REELS...
for all sizes and types of Electric Wire and Cable



Look at these advantages:

- *Reduced Reel Investment*
- *Less Storage Space*
- *Lower Freight Costs*
- *No Repair Costs*
- *No Return Freight Costs*
- *No Bookkeeping*
- *No Cash Deposits Req'd.*
- *No More Headaches ! !*

NON-RETURNABLE REELS ALLOW DEFINITE PACKAGING COSTS.

HIGH SPEED

SHIPPING SERVICE in our . . . OWN TRUCKS

within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

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MANUFACTURING COMPANY
HAZARDVILLE, CONNECTICUT

Telephone . . .
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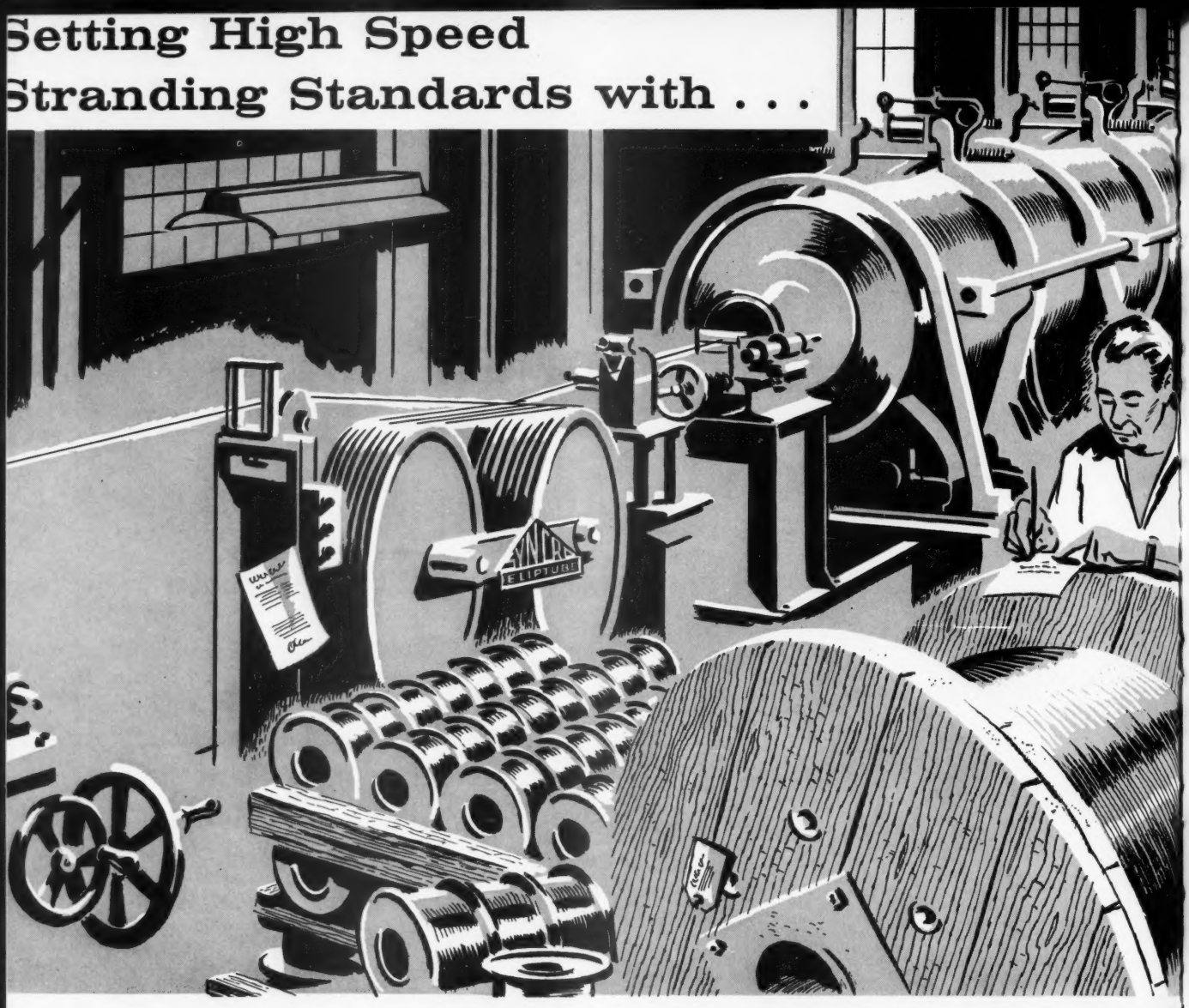
RIverview 9-8308

"REEL GOOD . . .

Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.

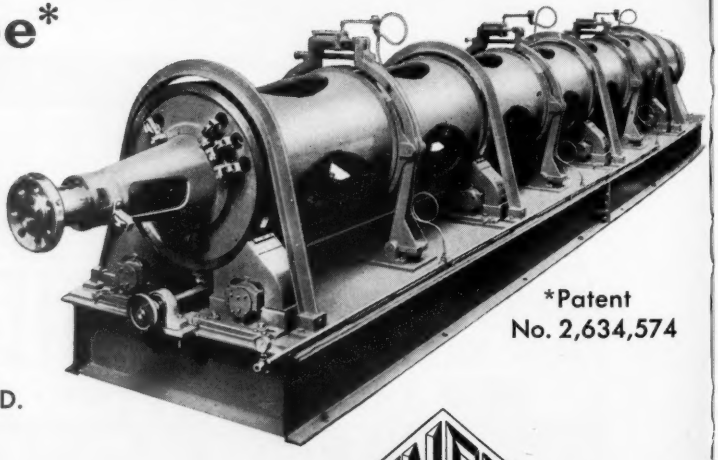
WOOD REELS"

Setting High Speed Stranding Standards with . . .



The Syncro Eliptube*

The high speed tubular stranding machine, skillfully designed and engineered to meet the increasing demands for higher production and greater profits, is a further example of Syncro's leadership and superiority in the manufacture of better machinery for the wire and cable mill industry. Tubular stranders, accommodating 6" - 8" - 12" - 16" and 22" diameter bobbins, are being used extensively for the production of ACSR, COPPER, and STEEL STRAND. Consult us for any stranding requirement.



*Patent No. 2,634,574

Syncro Machine Company

SYNCRO

Better Machinery for the Wire Industry

PERTH AMBOY, NEW JERSEY, U.S.A. AFFILIATED COMPANY: WINGET SYNCRO LTD. ROCHESTER KENT, ENGLAND

WIRE DRAWING MACHINES • DIE STRINGERS • CONTINUOUS ELECTRIC ANNEALERS • PAYOFFS • CAPSTANS • WIRE INSULATORS • HEAVY DUTY TAKEUPS • TAPERS • SPECIAL MACHINERY

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 31 June, 1956 No. 6

Designated as Official Publication By The Wire Association

Contents

Editor's Desk 653

Fourdrinier Wire Weaving
by William A. Kools 655

Semi-Annual Meeting of the Board of Directors of
The Wire Association 658

Modern Rod Baker Trends
by Carl Mayer, Jr. 659

Physical, Chemical and Electrical Properties of
Marlex* Ethylene Polymers
by Dr. R. Vernon Jones, Paul J. Boeke and Walter R. Clark 661

Stainless Steel Wiredrawing Through Diamond Dies
by W. F. G. Kerley 664

The Past 125 Years
by Harry G. Stoddard 672

Developments In Submarine Communication Cables
by J. J. Gilbert 675

Outstanding Personalities of the Wire Industry 685

A Review of Recent Wire Patents 693

Steel Statistics 702

Copper Statistics 703

Index to Advertisers 723

Where-To-Buy 724-728

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PB-120-T Box and Skid Unit equipped with tiering lugs.

REPUBLIC STEEL

Boxes and Skids

For Handling Wire and Wire Products

Design and construction features of Republic Boxes and Skids help speed movement of materials, conserve storage space, produce savings in all phases of materials handling. Fabricated from heavy-gage steel sheets, they feature deep reinforcing ribs for maximum strength and rigidity.

Units like the PB-120-T, shown above, are manufactured in a wide range of sizes. Republic Materials Handling Engineers will be happy to work with you in designing boxes and skids to meet your specific requirements. There is no cost or obligation for their service.

Write for Catalog 620 on the complete line of Republic Materials Handling Equipment.

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Pressed Steel Division
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( ) Please send Catalog 620.
( ) Have an Engineer call.

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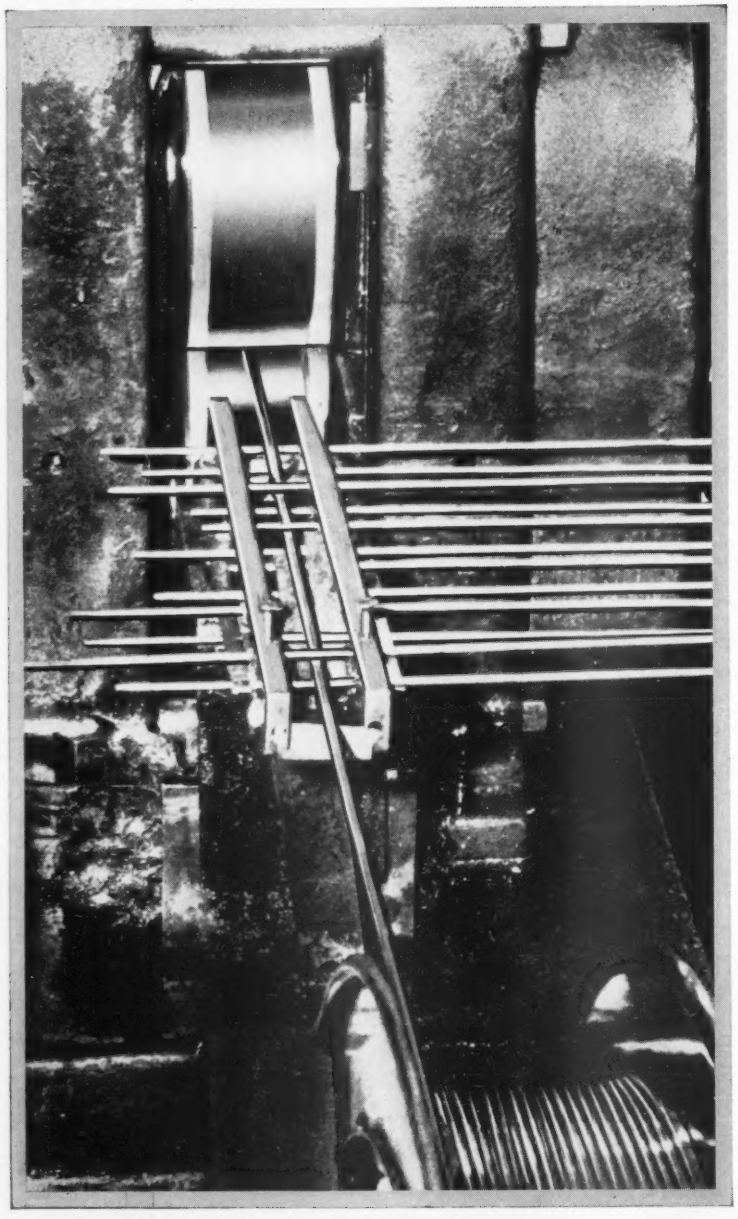
City_____ Zone____ State_____

C-2098

Carbide rolls outlast steel 25 to 1, and...

Produce flat wire with greater salability– and realize substantial manpower savings



Precision textile loom reed, produced at the Knowles Loom Reed Works, Inc., with Carboloy® cemented carbide rolls, has been noticeably free from the imperfections caused by steel rolls. Steel rolls mushed as they wore, crowning the wire and causing numerous rejections. The uniform tolerance of carbide rolls eliminated this. Further – the lasting high-luster finish of carbide rolls was imparted to the reeds. Such reeds were and are far more marketable than those produced with steel rolls.

This greater marketability assured greater profits – for the use of cemented carbide rolls also resulted in noticeable manpower savings. Steel rolls expanded and contracted under the heat of the run, requiring a man on every machine to inspect reed tolerances. Because carbides are not affected by heat, *one* man can now handle several machines.

All machine downtime due to roll changes as well as roll refinishing, has been eliminated. In fact, after 10 million revolutions – more than a year of continuous running on the same spot – the Carboloy cemented carbide rolls show no signs of wear.

This Knowles case history of improved product quality, reduced manpower and maintenance costs, and longer roll life is typical of the benefits Carboloy cemented carbides are bringing to the wire industry.

Whether your business is flattening, drawing, extruding, or heading, there's a Carboloy product to fit your needs. For more information, or in-plant assistance from a Carboloy Wire Die Engineer, write today.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11171 E. 8 Mile Ave., Detroit 32, Michigan

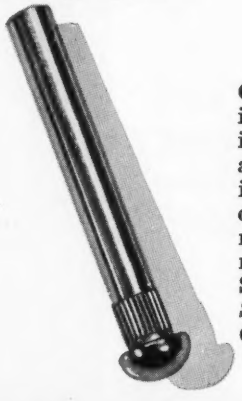
CHECK THE ADVANTAGES OF STAINLESS STEEL FASTENERS

✓ for boosting product quality!

Where appearance and performance call for quality parts, don't overlook the advantages of stainless steel fasteners. Take the illustrated E. W. Ferry fasteners, for example. They're priced right in line with quality fasteners of other materials. Yet they offer all the extra qualities stainless steel brings to any part — high tensile strength . . . attractive, rust-resisting finish . . . and remarkable resistance to heat and corrosion. In almost any application they outlast, many times over, fasteners of nonresistant or plated metal. They cut maintenance costs, too. For even after years of service, disassembling rust-free stainless fasteners is always a fast, easy operation.

✓ for reducing production costs!

The hardness of stainless steel fasteners results in substantial savings on the assembly line. Work is faster, results are better — simply because stainless screw-heads are less apt to burr and nick. This means major savings, for even a slipping screwdriver can seriously damage both the screw and the parts being assembled. Stainless steel fasteners cut tooling costs, too. For they are now available in practically every size and description.

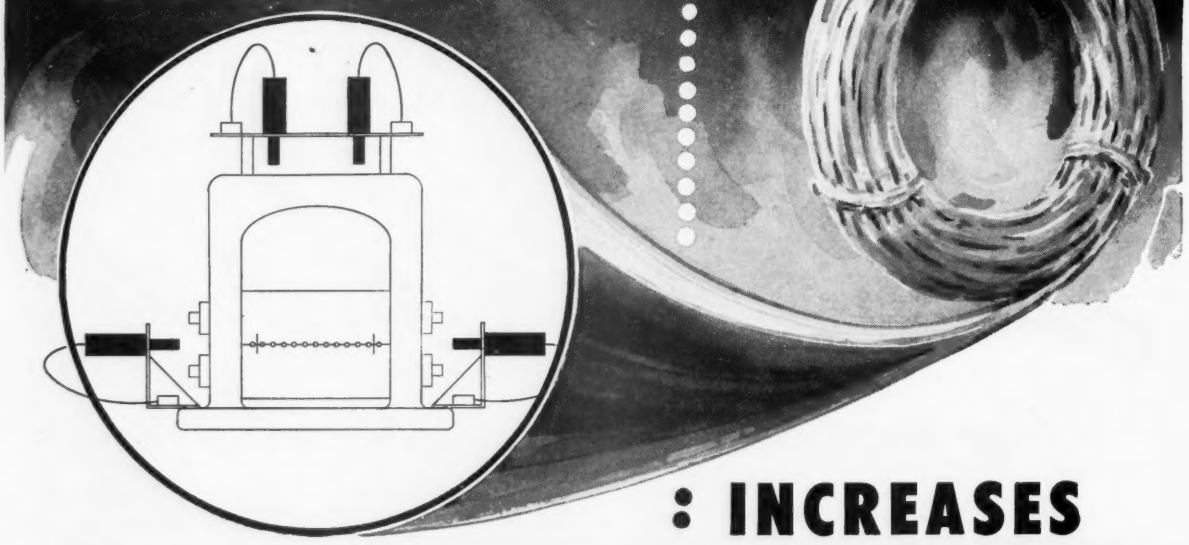


Crucible now offers stainless fastener wire in all diameters . . . in suitable tempers . . . in a variety of finishes, including bright and several metallic and nonmetallic coatings . . . in all standard grades. For prompt delivery of the stainless steel wire you need — or for your free copy of Crucible's new, 32-page catalog "Rezistal Stainless Steel Wire" — call or write to *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

THIS NEW LOOK IN ROD MILLS.....

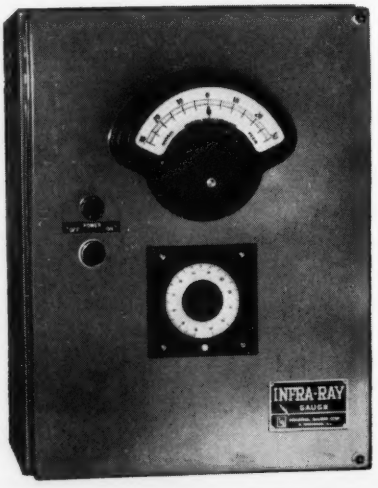


: INCREASES YOUR PROFITS

Here's how:—Hot rolled rod dimension control is now made more accurate by means of our non-contact gauges. Your operators produce rods with a minimum of waste by holding to the tolerance required. Shrinkage losses are reduced at coil starts and ends resulting in a more uniform, more profitable product.

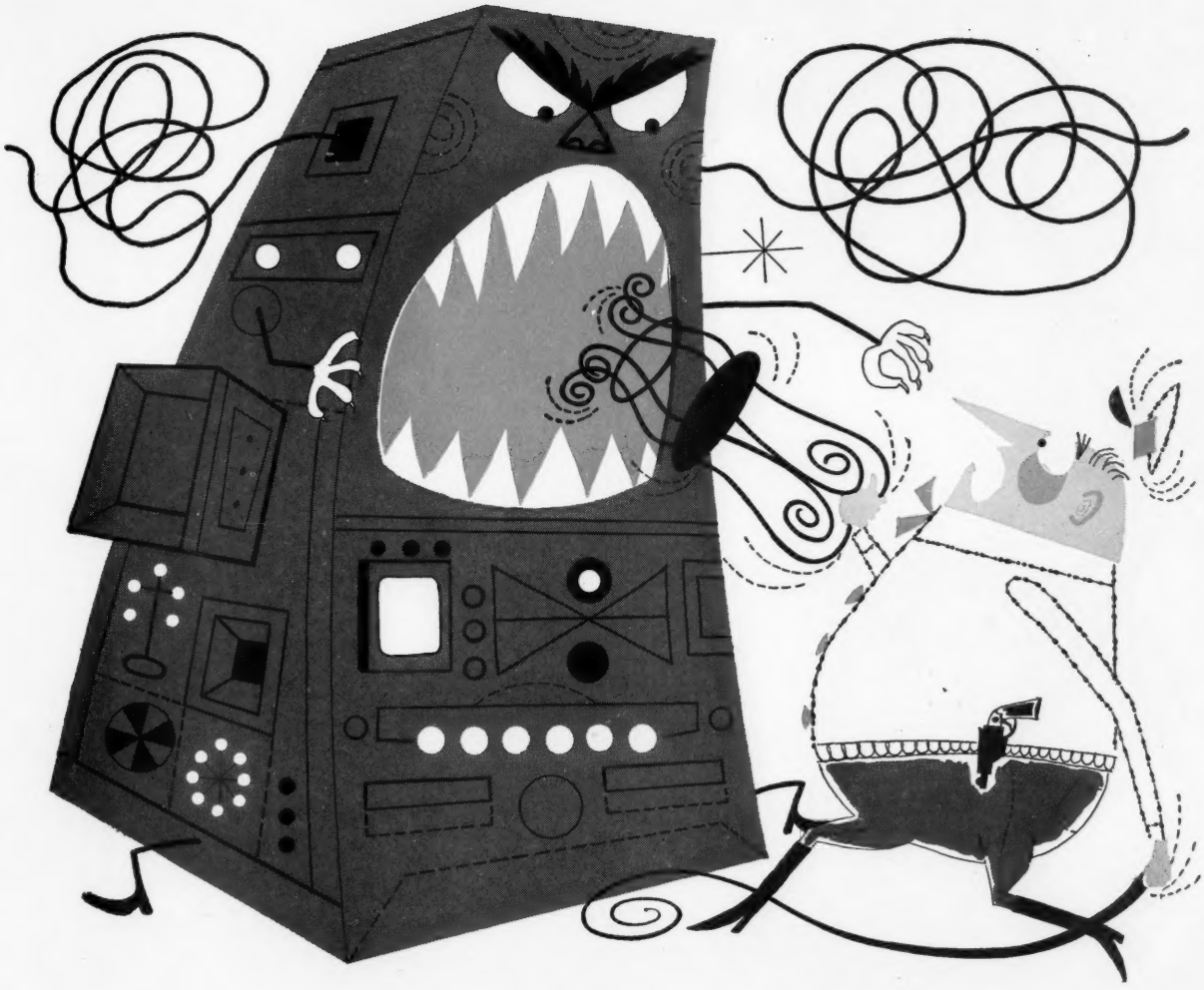
INFRA-RAY GAUGES

Can measure out of roundness by simultaneously scanning both vertical and horizontal dimensions of the hot rods. When these gauges signal off—tolerance, operators adjust rolls accordingly.



For further information . . .

INDUSTRIAL GAUGES CORPORATION • WEST ENGLEWOOD, NEW JERSEY



Taming a wire fabricating machine?

Call American Steel & Wire!

Wire machines can be ornery. They seem to have a brain that delights in fouling up a high speed production line.

Very frequently, your American Steel & Wire representative can tame things down. With over a century of company experience behind him, he may be able to suggest a minor change in wire specifications, die construction or fabricating procedure that will solve the problem.

At AS&W, we *use* a lot of wire in our own plants, and have learned a lot of little tricks that are yours for the asking. Just call your American Steel & Wire representative.

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USS AMERICAN MANUFACTURERS WIRE

USS TRADE MARK

AMERFINE—*high quality fine wire.*
AMERSPRING—*music steel spring wire.*
AMERTEMP—*heavy-duty oil-tempered wire.*
AMERLOY—*alloy heading wire.*
AMERHEAD—*uniform heading wire.*
AMERSTITCH—*extra-tough metal stitching wire.*

UNITED STATES STEEL

Cold-formed parts by the million—yet dies stay like new!

The secret:

FOS lubrication by Pennsalt

The way to fast, efficient cold forming—with minimum rejects, long die life, and cost savings as high as 50%—is through the thorough lubrication provided by Pennsalt's FOS Process. Specialized FOS lubricant systems assure the vital separation of cold-forming wire from the dies, preventing welding and galling . . . boosting press production . . . saving tools and materials.

WHAT'S THE FOS PROCESS? A method offering the most comprehensive selection of phosphate coatings and organic lubricants ever designed for cold-working applications. Pennsalt FOSCOAT®, DRAWCOTE®, and FOSLUBE® products have been developed for every forming operation from severe deep drawing and extrusion to simple cold heading.

CALL ON PENNSALT'S EXPERIENCE in metalworking chemistry for advice on your cold-forming lubricant needs. Hear what your Pennsalt service man has to say about FOS, or write Metal Processing Department 267, Pennsylvania Salt Manufacturing Company. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: 2020 Milvia Street., Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

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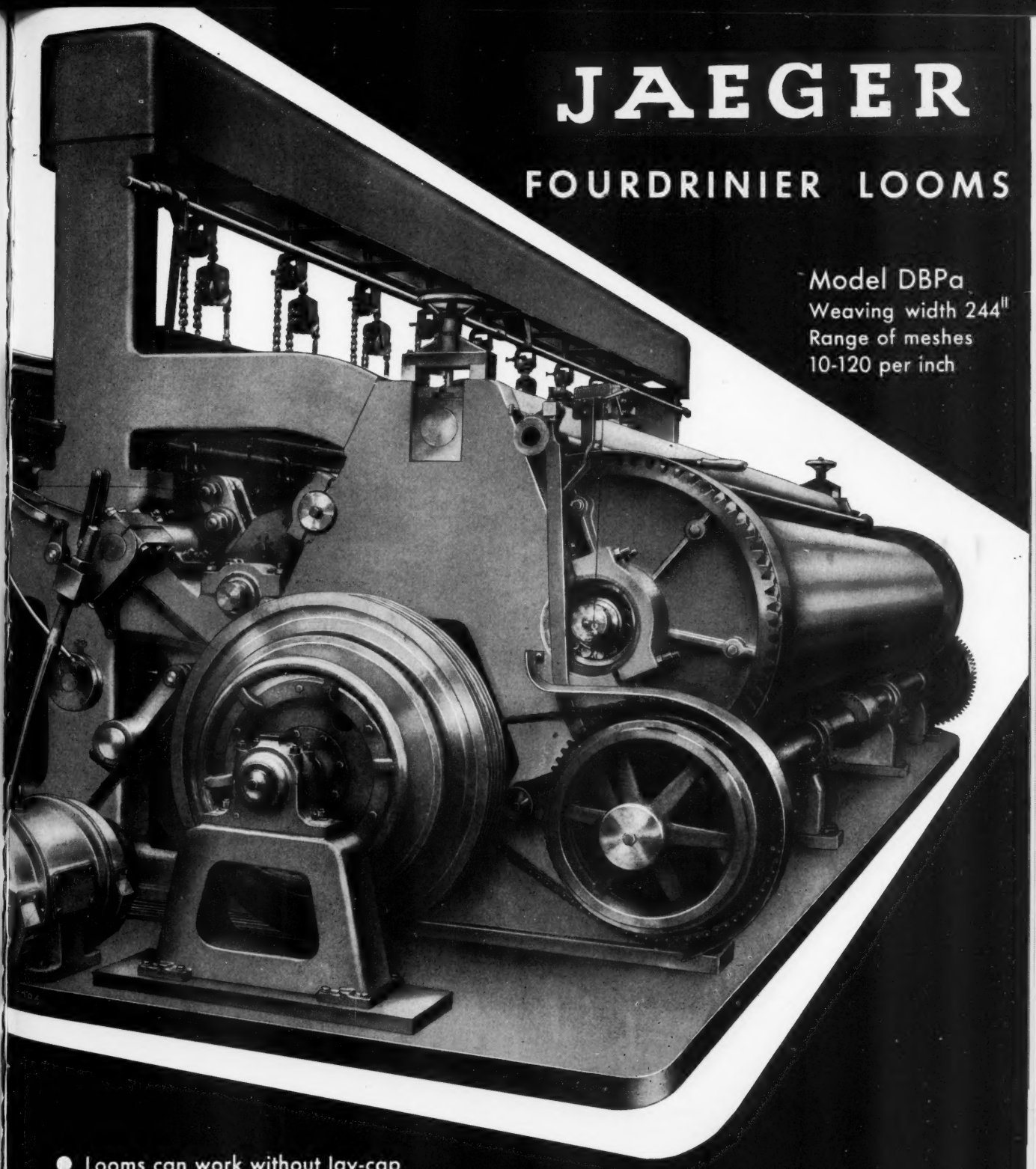
Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

A BETTER START FOR YOUR FINISH

JAEGER

FOURDRINIER LOOMS



Model DBPa
Weaving width 244"
Range of meshes
10-120 per inch

- Looms can work without lay-cap
- 2-4 driving arms for the lay according to width
- We have a complete line of wire looms and auxiliary machines

Sole Representatives for U.S.A. and Canada

CEDAR-WEST TOOL COMPANY INC.

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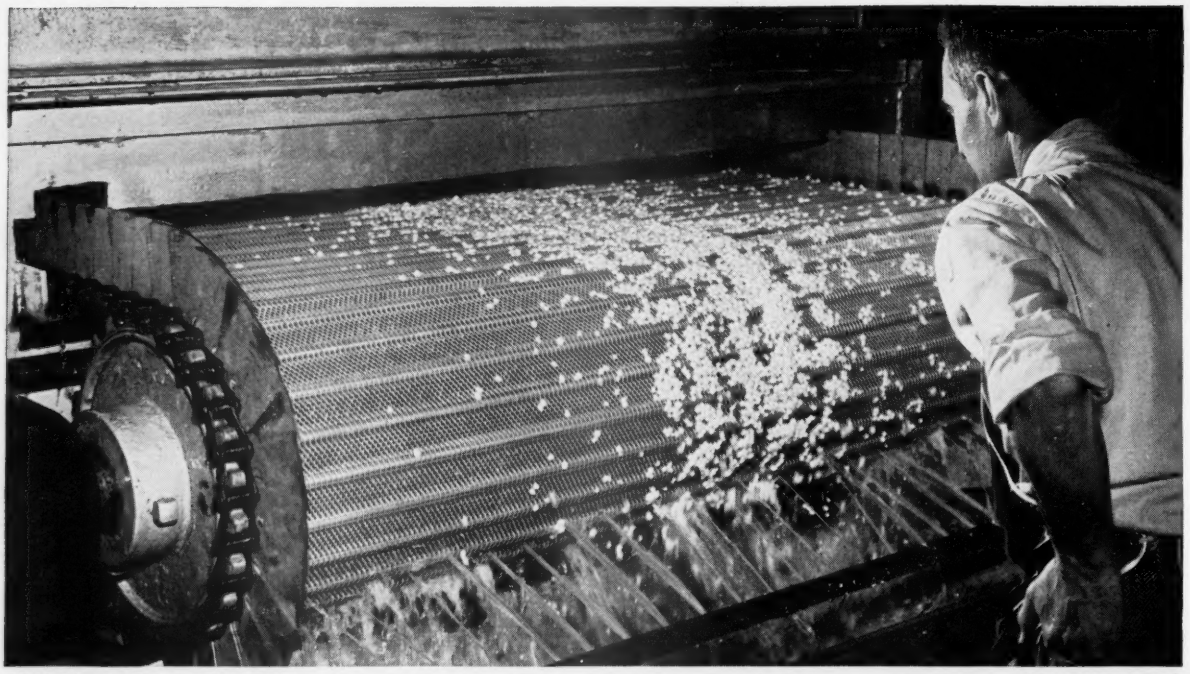


FIGHTS CORROSION — Bethanized wire takes a constant dousing from sprays of scalding steam and cold water as it keeps cut corn on the move in a food-freezing plant. Conveyor belt made by the Cambridge Wire Cloth Co., Cambridge, Md.

No Corrosion Here

Bethanized Wire is armored by pure electrolytic zinc

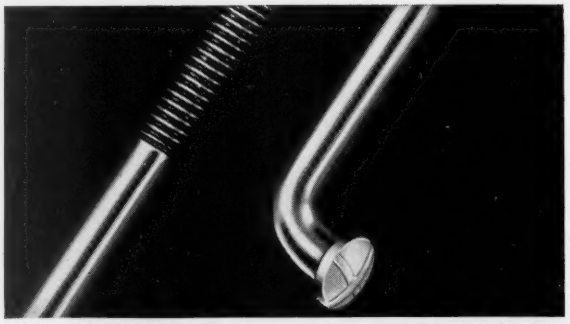
Need steel wire with plenty of corrosion-resistance? You'll find it hard to beat bethanized wire. We make it with four standard coating weights.

The bethanized coating is locked on, atom by atom, by our unique electrolytic process. Thanks to this tight bond, plus the purity of the zinc, the coating is highly ductile, and can stand severe forming.

You can bend bethanized wire, twist it, wrap it, swage it, weave it—even draw it through dies—and the zinc coating stays on. Some users even roll-thread bethanized wire, cold-head it and weld it.

The bethanized coating is amazingly uniform, too, without any thin spots to invite corrosion. The lighter bethanized coatings are ideal for most applications. But when corrosive conditions are severe or maximum protection is desirable, there are heavier coatings to choose from. And they cost very little more.

Why not let the sparkle of pure zinc add eye-appeal to your wire products? Right now is a good time to find out what bethanized wire can do for you. Our nearest sales office can give you complete details. Or write us for a copy of Folder 615.



TAKES SEVERE FORMING — These are opposite ends of a bicycle spoke made from high-carbon bethanized wire. The hub end is upset and bent. The rim end is roll-threaded. The pure zinc flows during such operations.

STRIPPING TEST VALUES

(determined in accordance with A.S.T.M. Spec. A-90-53)

Ounces of zinc (minimum) per sq ft of bare wire surface

Gage	Type 2 Coating	"A" Coating	"B" Coating	"C" Coating
6	0.70 oz	0.90 oz	1.80 oz	2.70 oz
9	.60	.80	1.60	2.40
12	.50	.80	1.60	2.40
16	.35	.50	1.00	1.50

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

flawless faster die finishing with scientific compounds

Modern die manufacturers such as New Jersey Carbide Die Co. demand Hyprez, the original Diamond Compound

HYPREZ

For economy of production and for finish to exact specification, New Jersey Carbide Die Co. uses Hyprez exclusively

High Precision DIAMOND COMPOUNDS

Serving many of the foremost plants in the wire industry, New Jersey Carbide Die Co., of Jersey City, uses Hyprez exclusively for rough finishing, lapping and polishing tungsten-carbide dies.

The continuing preference for Hyprez is built upon Hyprez superiority—maintained by research and control; by fast free-cutting action of pure diamonds precisely graded and uniformly dispersed in scientifically formulated vehicles. Hyprez provides the exact grade and concentration for every job.

Ask for a free demonstration

or technical bulletin No. W-656

HYPREZ DIVISION

ENGIS EQUIPMENT COMPANY, CHICAGO 5, ILL.

431 SOUTH DEARBORN ST.

SCOVILL WIRE

COPPER-BASE ALLOY

available in . . .

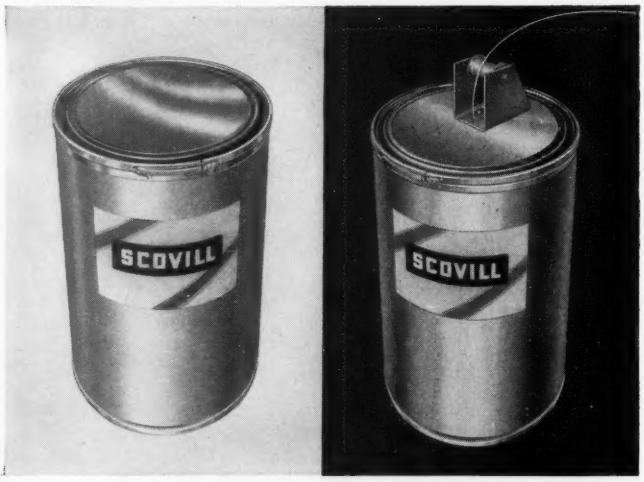
payoffpak

Here is one of the most important and practical "differences" Scovill has made available to wire formers. PAYOFFPAK is the NEW optional (without extra cost) method for packaging Scovill Copper-base alloy Wire, resulting in immediate time and cost-saving advantages to you. Check these advantages listed below . . . then get in touch with us at Waterbury, or at your nearest Scovill sales office listed below.

WIRE IS FED DIRECTLY FROM DRAWING MACHINE INTO PAYOFFPAK.

SHIPPED TO CUSTOMERS FULLY PROTECTED, CLEARLY LABELED . . . EASY TO INVENTORY.

SCOVILL'S WIRE PAY-OFF FEEDER ELIMINATES REELS OR SPOOLS.



LONG CONTINUOUS RUNS from UP TO 500 lbs. of wire in a single strand . . . with assured smooth-running pay-off, from the first foot to the last.

READY-TO-FEED pay-off to wire forming machines **eliminates** reels or spools.

LESS DOWN-TIME between runs . . . no small coils to change constantly.

MUCH EASIER HANDLING and storage . . . PAYOFFPAKS can be stacked.

PROTECTION to wire in shipment and storage.

NO EXTRA COST. Any Scovill Copper-base alloy Wire may be ordered delivered in the PAYOFFPAK in the following sizes and tempers: Diameters .016″ to .060″ inclusive any temper except SOFT. Diameters over .060″ to .212″ inclusive SOFT temper to 2 Nos. HARD.

SCOVILL MANUFACTURING COMPANY, WATERBURY 20, CONNECTICUT

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LOS ANGELES 22, CALIFORNIA: 6464 EAST FLOTILLA STREET

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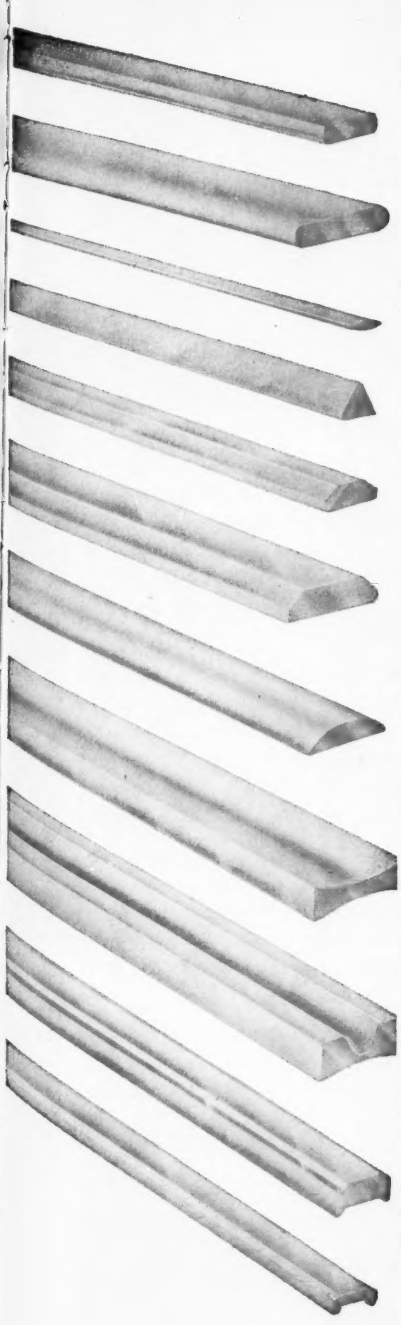


NATIONAL WIRE

(COLD ROLLED)

in Coils or Straight Lengths

COMPLETE METALLURGICAL SERVICE

Manufacturers of

SPRING WASHERS	RETAINING RINGS
ROUND EDGE FLAT WIRE	KEYSTONE SHAPED WIRE
SQUARE EDGE FLAT WIRE	SPECIAL SHAPED WIRE

Shaped Wire in Coils or Straight Lengths, Ferrous or Non-Ferrous.

LARGE OR SMALL QUANTITIES

Manufactured by

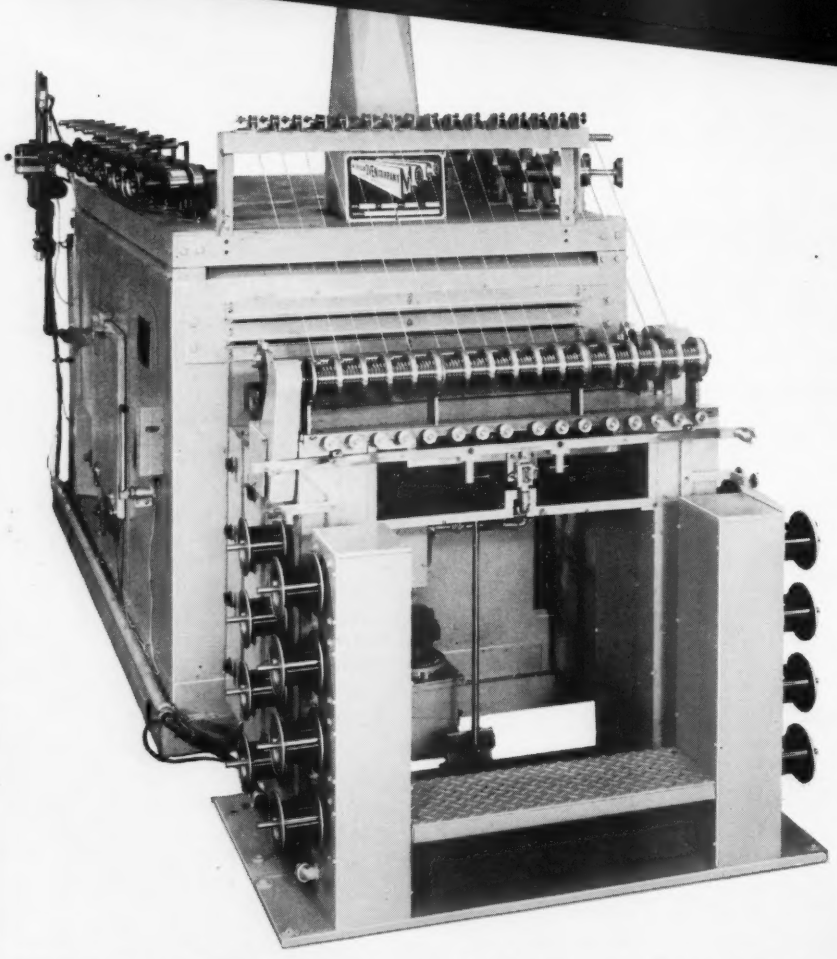
THE NATIONAL LOCK WASHER COMPANY

PRECISION SHAPED WIRE DIVISION

NEWARK 5, N. J. MILWAUKEE 2, WIS. U.S.A.

ANOTHER ENGINEERING ACHIEVEMENT BY **MOCO**

Now—A New Wire Enameling Machine That Produces MORE POUNDS OF FINISHED WIRE Per Hour with Commercial Grades of Varnish!



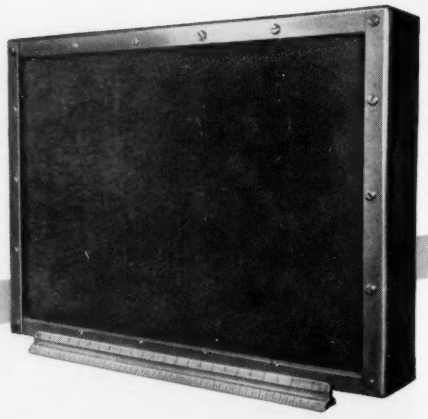
This type "B" wire machine handles wire from 31 A.W.G. to 42 A.W.G. Five other models complete the cycle—from the finest to the heaviest wire. The unique design of the horizontal, high volumetric, recirculating double-pass oven allows greatly increased production by rapid heat impartation and a high degree of temperature uniformity throughout the wire chamber. It is seven feet long inside, with an internal recirculating fan and fume consuming catalyst. The oven can be operated by either gas or electricity.

For the first time, modern recirculating oven features—developed in recent years in the electrical manufacturing field—have been combined with the latest wire handling and coating machinery.

Here's a production capacity example: This machine consistently produces 16 heads of #33 A.W.G. with four or six coats of commercial, oleo-resinous or formvar enamels at wire speeds far in excess of 100 f.p.m.

Some of the leading wire manufacturers in the country have seen this machine in full operation in Detroit. They agree: It's a completely revolutionary development in the field of wire enameling equipment.

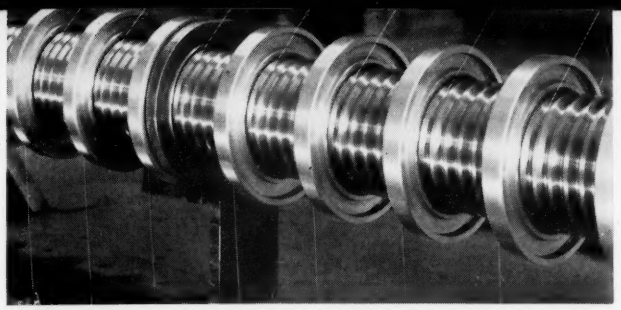
Here, in picture-caption form, is part of the story. For complete information, fill in the handy coupon on the next page.



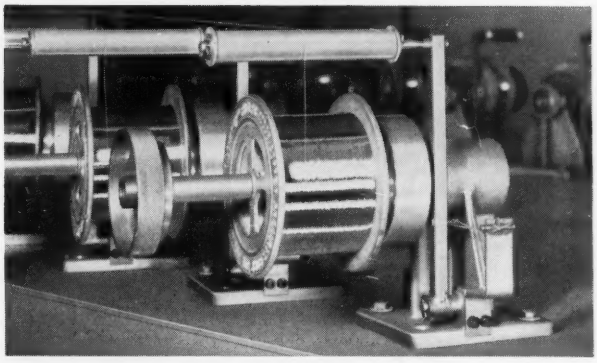
A catalyst is installed within the recirculating stream. Solvents are consumed as they are liberated. They are transformed into usable B.T.U.'s thus reducing the amount of energy from the heat source (either gas or electricity). Results: economy, odor-free exhaust, condensate free stacks, greatly reduced fire hazard.

MOCO

Photograph courtesy of Catalytic Combustion Co.

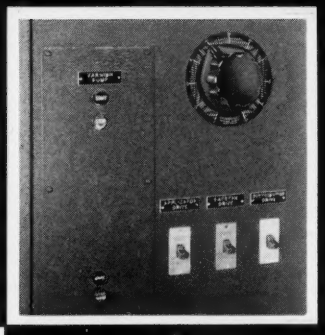


Each head of the wire capstan assembly is fitted with individual clutches at the capstan. Any or all of the lines can be started or stopped without affecting the remaining lines. Each strand is individually driven through the oven, lessening the overall tension applied to each line.

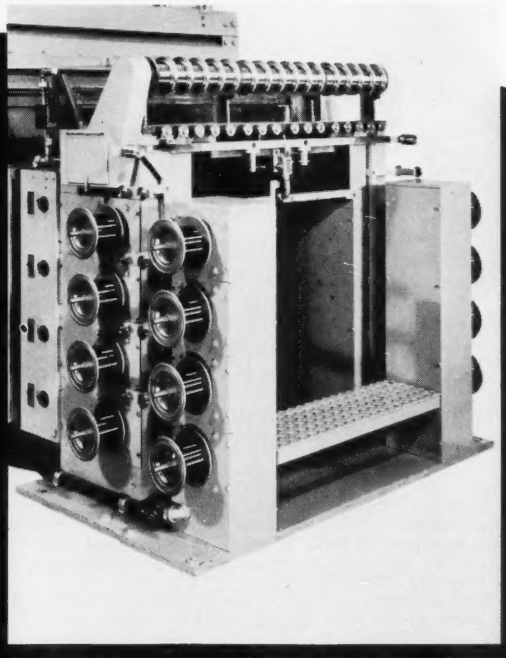


The bare wire pay-off mounts are rigidly mounted at a convenient operational height at the top of the oven. Wire tension is controlled by an automatic braking device.

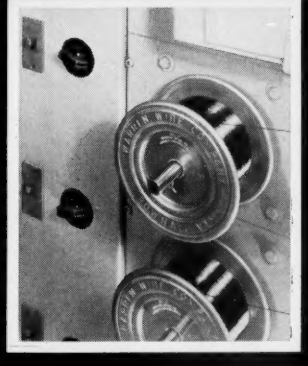
The centrally located, efficient oven control panel makes operating the oven considerably easier. Experienced engineering has incorporated the ultimate in workmanship, simplicity and safety.



This finger-tip wire control panel brings the capstan and varnish handling equipment into a central point easily accessible to the operator.

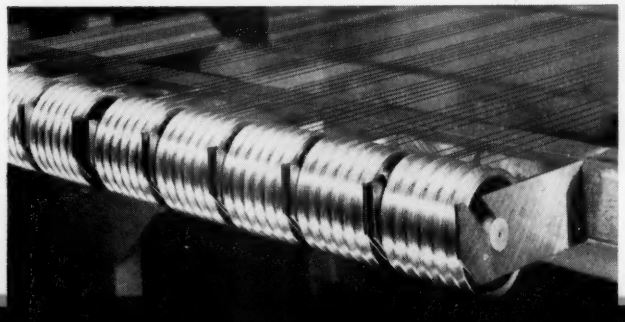


The take-up spools on the unit console are driven by separate torque motors with individual trimmer power stats. All are controlled by a main power stat which also controls a reciprocating wire distributor with adjustable stroke length for laying uniform layers of wire on the spools.



Individual torque motor rewinds with micro-adjustment power stats. A simple arrangement of the rewind spools on the console allows easier spool changes even at the high speeds in which the unit operates.

Below: Precision-grooved sheaves with graduated depths of machined aluminum have free-turning nylon bearings.



MICHIGAN OVEN COMPANY

425 Brainard • Detroit 1, Michigan

MOCO

Please send complete information on the new Type "B" MOCO Wire Enameling Machine.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

SWAGING DIES

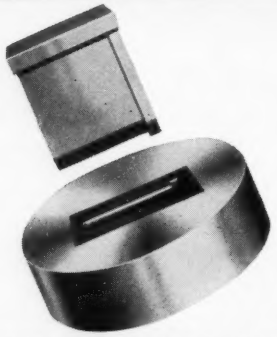
Leading Fountain Pen Manufacturer cold swages 33 times more stainless steel parts with TALIDE dies.

HEADING AND EXTRUSION DIES

Cold-heading 1/4". C-1008 steel rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

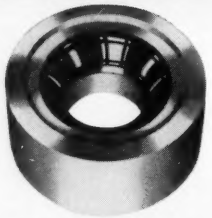
CURLING ROLLERS

TALIDE Curling Rolls last 65 times longer than steel rolls on beverage can forming operation.



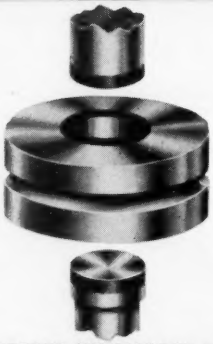
BLANKING AND FORMING DIES

70 times more paper discs blanked out with TALIDE — over hard alloy die.



SHEET METAL DIES

137,000 hi-alloy steel Pressure Vessels drawn with TALIDE, against only 7,900 with steel dies previously used.



POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE Pill dies last 4 months, steel dies wore out in 6 hours.

25,680,000 PARTS PRODUCED with ONE TALIDE DIE

A large electrical equipment manufacturer was having difficulty maintaining production of electrical outlet boxes. Die costs were high, downtime and scrap excessive. It was necessary to remove and repolish the hi-carbon, hi-chrome die every 60,000 pieces. Total production secured from each steel die averaged 700,000 pieces.

After an initial survey, our die engineers designed and installed a **Talide** die using **Grade C-88.** Operation is performed on a 75-ton double action Bliss press. Original die was put in operation 3 years ago and is still going strong, having been removed only once for repolishing — after drawing 15,000,000 pieces!

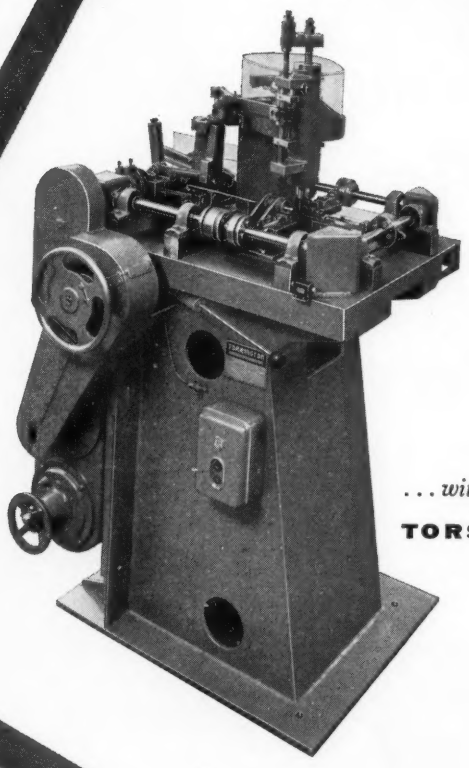
Total production obtained to date has reached the astounding figure of 25,680,000 outlet boxes — 36 times more production than when using a steel die. The Talide die costs $1,125.00 compared to $500.00 for each steel die. Savings in die cost alone has amounted to over $18,000.00 over the past 3 years, with substantial additional savings realized in increased production. Downtime, repolishing cost and scrap expense were completely eliminated.

Call in a **Talide** sales engineer for recommendations on how to solve your particular die problem. Phenomenal runs and tremendous savings in operating costs are assured when **Talide** dies are put on the job. Our files contain hundreds of case histories on every type of application — including draw presses, punch presses, pill presses, cold headers, swagers and draw benches.

METAL CARBIDES CORPORATION, 6001 Southern Boulevard, Youngstown 12, Ohio

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

There's room for greater profits



. . . with the NEW Torrington W3001
TORSION SPRING WINDER

Room — room in which to work — is the outstanding feature of Torrington's new torsion spring winder. This modern, high production machine actually provides the largest tooling area ever devised. In addition, the W3001 offers many other advantages which will help spring-makers boost their production of torsion springs and reduce their costs at the same time.

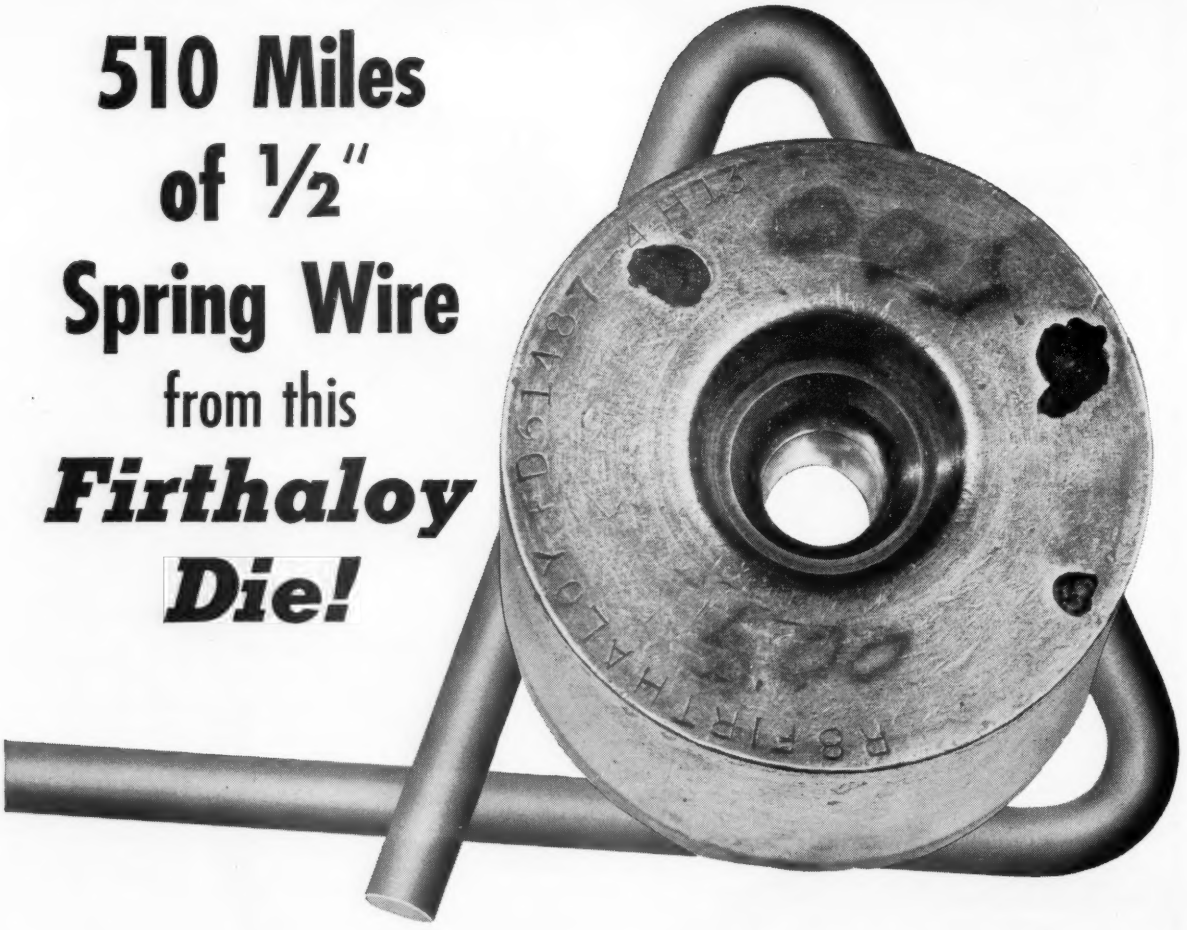
• Tooling area measures 12″ by 18″ • Tooling is faster and easier • Tools themselves can be made sturdier and more durable • Shafts on 3 sides plus vertical 2-slide attachment give great versatility in producing complex forms • Capacity extends to 10 turns of .080″ wire, thus meeting the great majority of customer requirements for torsion springs • Rugged design means years of trouble-free operation with minimum downtime for maintenance and repairs.

The Torrington Manufacturing Company has built more spring coiling machinery since 1937 than all other manufacturers combined. The knowledge and skill gained while serving spring makers during this period has now been used to create a torsion winder which we firmly believe is the finest ever offered to the industry. If you manufacture torsion springs, this new machine will give you faster, more efficient production and unprecedented versatility to meet your customers' most exacting needs.

Call or write, *now,* for full information.

THE
TORRINGTON
MANUFACTURING COMPANY
TORRINGTON · CONNECTICUT
WIRE FORMING MACHINERY DIVISION

510 Miles of ½" Spring Wire from this *Firthaloy Die!*



The unretouched photo of the Firthaloy draw die above may not be very pretty—but what die would be after drawing 1,800,000 lbs. of ½" high carbon spring wire! The important fact is, that despite the appearance of the steel casing, the Firthaloy carbide nib (standard grade H-13) had worn *only 1/1000 of an inch when it was retired after 6 years of continuous service!*

The leading New England manufacturer who returned the die to us for our "museum" thinks his 1948 purchase was a good one.

You, too, can get comparable results when you specify *Firthaloy* for your own die shop or from your tool and die maker . . . in round, square, hex and all special shapes.

Write for information or literature today

Mr. Tooley says—

"Firth Sterling offers wire manufacturers and fabricators the advantages of a *single* source of supply for both tungsten carbide dies and high grade die steels. This *complete* line, from famous Firthaloy carbide through almost one hundred grades of high speed and tool steels saves you time and money."

R-312

Firth Sterling

—INC—

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MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

FIRTH STERLING TRADE MARK

HUBBARD HAS IT!

HUBBARD HAS IT!

STEEL SHIPPING CONTAINERS

FOR

WIRE PAK

FEATURING:

- TOP AND BOTTOM SUPPORT FOR THE INNER CORE.
- SMOOTH SEAMS THROUGHOUT.
- PROMPT RAIL OR TRUCK DELIVERY.
- HUBBARD WIRE PAK PAILS HAVE SALVAGE VALUE.
- APPROVED STANDARD SPECIFICATIONS.
- CONTAINER TOPS AVAILABLE WITH RING OR LUG TYPE SEAL.

Hubbard Spool Company is proud to announce exclusive representation to the wire and cable industry for the Vulcan Containers, Inc. — manufacturers of all types of steel containers.

HUBBARD CONTAINERS HAVE MANY VALUES—

Write to us for details

HUBBARD SPOOL COMPANY

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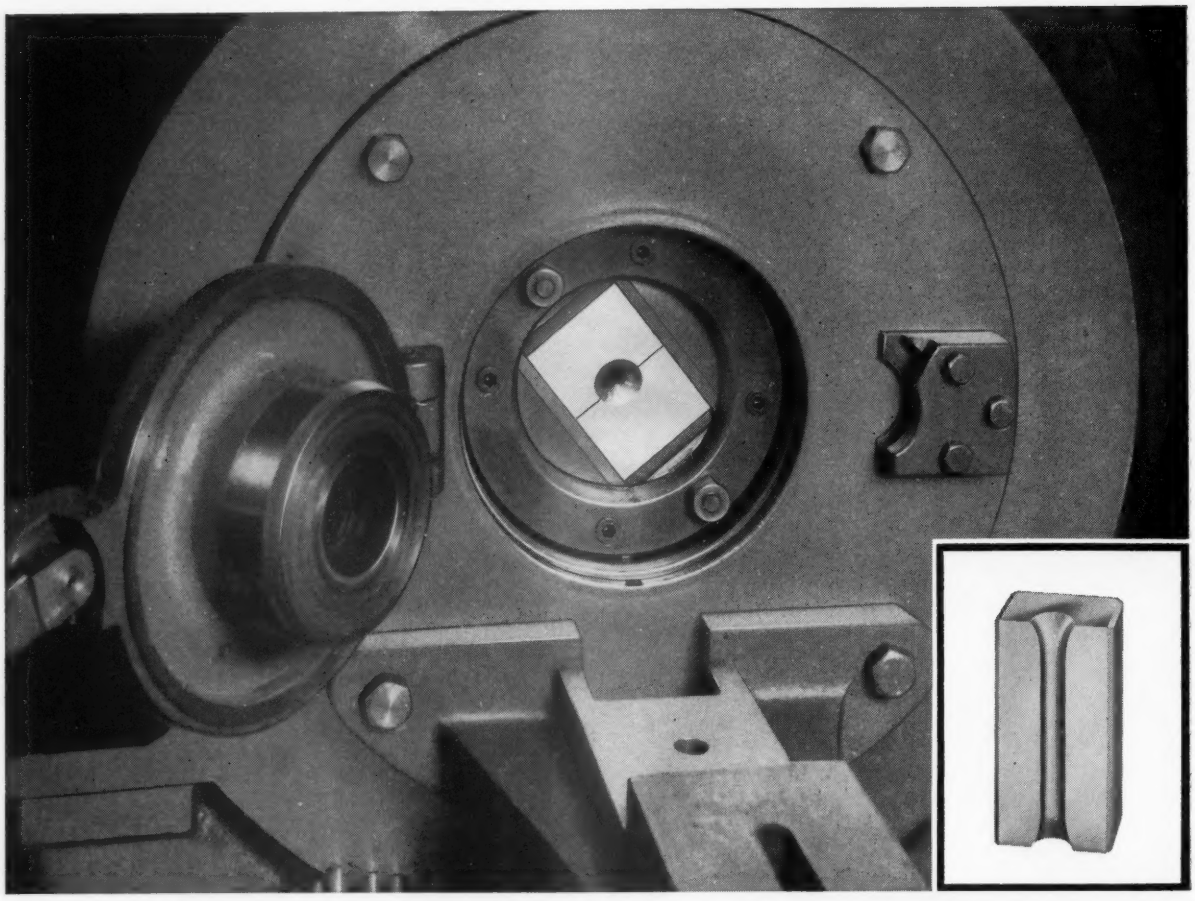
"THE BIGGEST NAME IN SPOOLS AND REELS"



KENNAMETAL* Dies swage up to 50 times more pieces than steel

with more accurate dimensions and better quality

By switching to dies made of Kennametal Grade K90, a manufacturer of hand tools has obtained these important benefits on a hot swaging operation:

- increased production of swaged steel alloy rods from 100 to 1000 pieces between dressings . . . machine down time greatly reduced.
- swaged pieces are now more uniform and of better quality.
- the Kennametal dies are outlasting the steel dies 30 to 50 times.

Although the Kennametal die blocks cost about five times more than the steel dies previously used, they quickly pay for themselves and show substantial profits on the investment.

As Kennametal dies and die sections are showing similar results on many types of operations, why not select Kennametal for your next die parts . . . for blanking, compacting, cold heading, cupping, drawing, forming, perforating, piercing, slitting, stamping or swaging.

You can choose from Kennametal's "90 Series" with six grades or the exclusive non-galling "80 Series" with three grades. These grades provide a range of carbides that meet the specific requirements of any die application.

A Kennametal die engineer will gladly work with you or your die maker in applying the right grade of Kennametal for your dies. Call him at your nearest Kennametal office or write to KENNAMETAL INC., Latrobe, Pennsylvania.

*Registered Trademark

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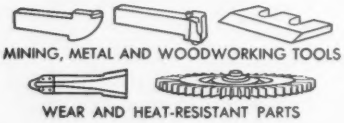
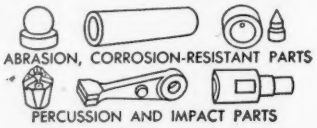


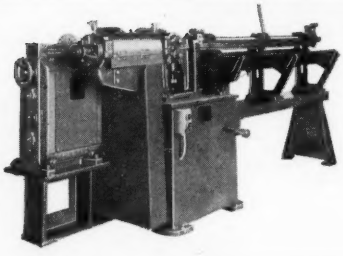
INDUSTRY AND
KENNAMETAL
...Partners in Progress



WIRE STRAIGHTENING SPECIALISTS FOR 90 YEARS!

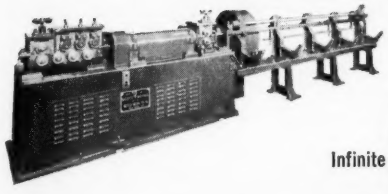
SHUSTER wire straightening and cutoff news!

SHUSTER — the first name in wire straightening and cutting, now presents a full range of *infinite variable speed* machines — first in the field again!



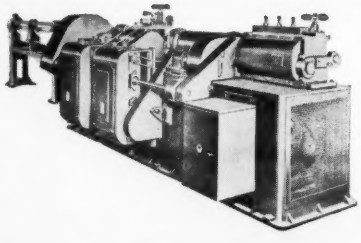
SHUSTER 1 AV

1/16″ to 3/16″ or 3/32″ to 1/4″ basic wire Geared to feed any speed from 50 to 200 feet per minute.



SHUSTER 3 AV

1/4″ to 1/2″ basic wire. Geared to feed any speed from 76 to 228 feet per minute. Infinite speed control of cuts per minute



SHUSTER 4 AV

3/8″ to 11/16″ basic wire. Geared to feed any speed from 90 to 180 feet per minute. Infinite speed control of cuts per minute.

INFINITE VARIABLE SPEED DRIVE!

Infinite feed changes and control.
The speed you want when you want it.
Constant speed maintained when set regardless of load variations.

ELECTRICALLY CONTROLLED CLUTCH AND TARGET!

Fewer wearable parts.
Roll type mechanism.
Solenoid actuated, feather touch control!

MINIMUM MAINTENANCE!

Frees operator from worry!
Speeds Production!

Send for FREE wall size split gauge wire chart from 41 gauge to 7/0

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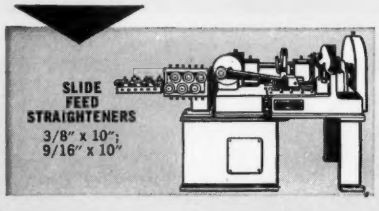
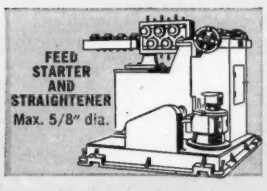
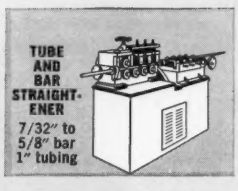
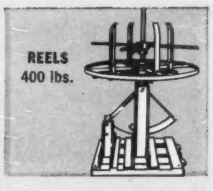
MACHINE TOOL, INC.
155 West Adeline Street, New Haven, Conn.

This too is SHUSTER.









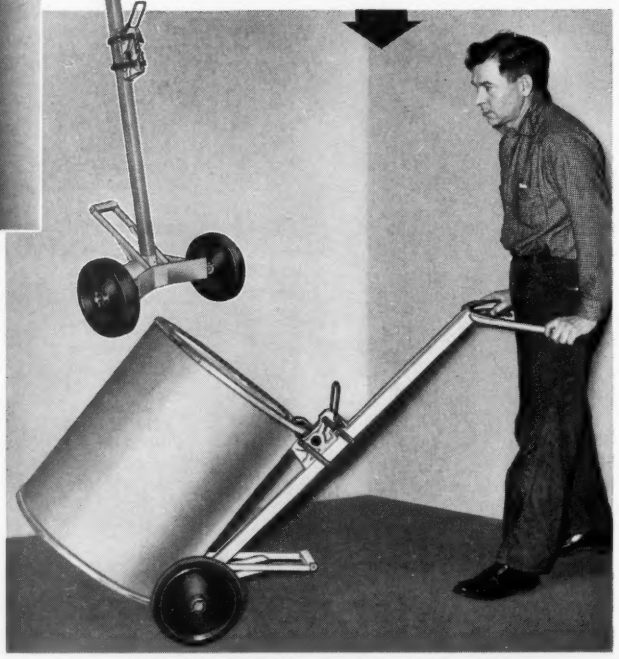
MOVE YOUR Leverpak / Payoffpak } FIBRE DRUMS (OR STEEL)

with MATERIAL HANDLING EQUIPMENT **LIFT-O-MATIC**

- SAFELY
- AUTOMATICALLY
- EASILY
- ECONOMICALLY

MANUAL DRUM TRUCK

Automatic engagement and release. No prongs or studs to damage drum. Quickly adjustable for drums of any height. Exact placement without any manual handling. Light, (45 lbs.) all-steel welded construction. Steel disc wheels, with full roller bearings, equipped with solid demountable or molded-on rubber tires.



POWER TRUCK ATTACHMENT

One operator can attach or remove in only 2 minutes. Fits any truck, or can be interchangably used on different makes. Engages drum from top only, without damage to bead or rim. Handles all drums, singly or in multiples, regardless of size or kind, open or closed. Automatic, mechanical, maintenance-free operation, without additional operator control. No pallets needed for transporting or tiering.

MARVEL INDUSTRIES, INC.

2240 CLEVELAND STREET • EVANSTON, ILLINOIS

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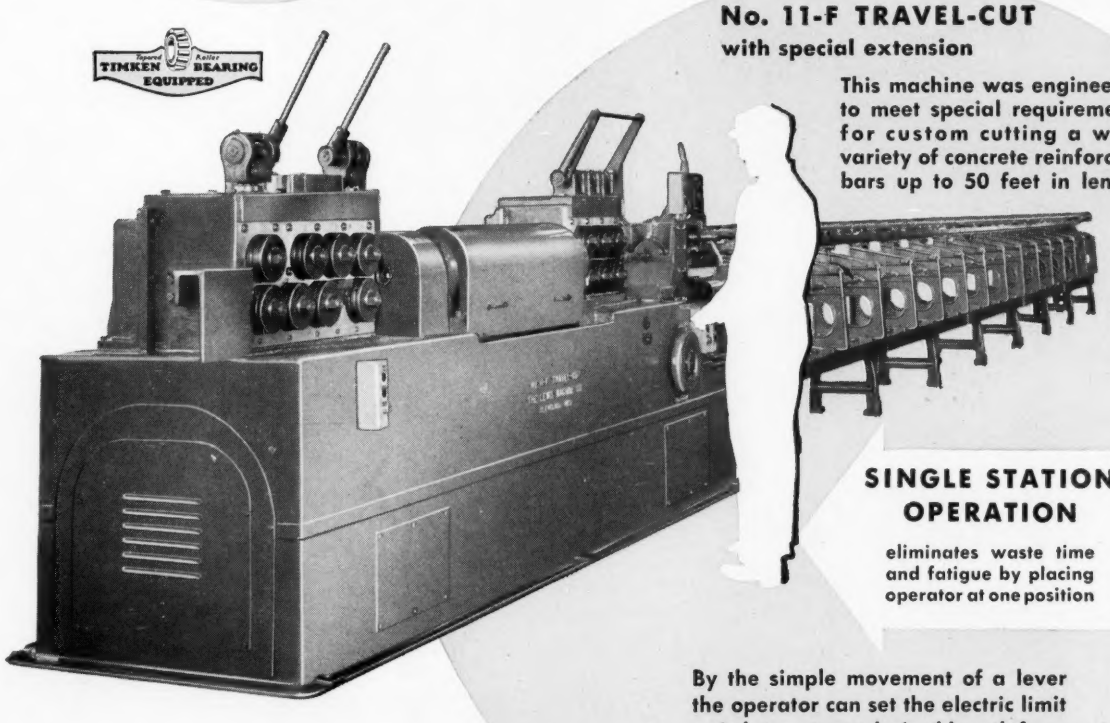
OR WRITE US

LEWIS

Machines can solve any wire straightening or cutting problems



No. 11-F TRAVEL-CUT
with special extension

This machine was engineered to meet special requirements for custom cutting a wide variety of concrete reinforcing bars up to 50 feet in length

SINGLE STATION OPERATION

eliminates waste time and fatigue by placing operator at one position

By the simple movement of a lever the operator can set the electric limit switch to cut any desired length from 6 to 50 feet. A dial graduated in feet and inches tells him the exact length the machine will cut. A preset counting device stops the machine when the proper number of pieces is cut.

Any predetermined number of pieces may be cut with this equipment to any predetermined length without the operator moving from his regular position at the machine.

There is a Lewis Machine design to straighten and cut all materials and shapes in wire and or bar stock from .012″ to ¾″ diameter at a wide range of speeds. If you have a wire straightening and cutting problem, or special requirements for a job, ask us for information and suggestions about how Lewis Machines can increase your production, control your quality and greatly reduce your costs.

New illustrated brochure available on request.

THE LEWIS MACHINE COMPANY

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HIGH QUALITY

fiber glass yarns for wire and cable insulation

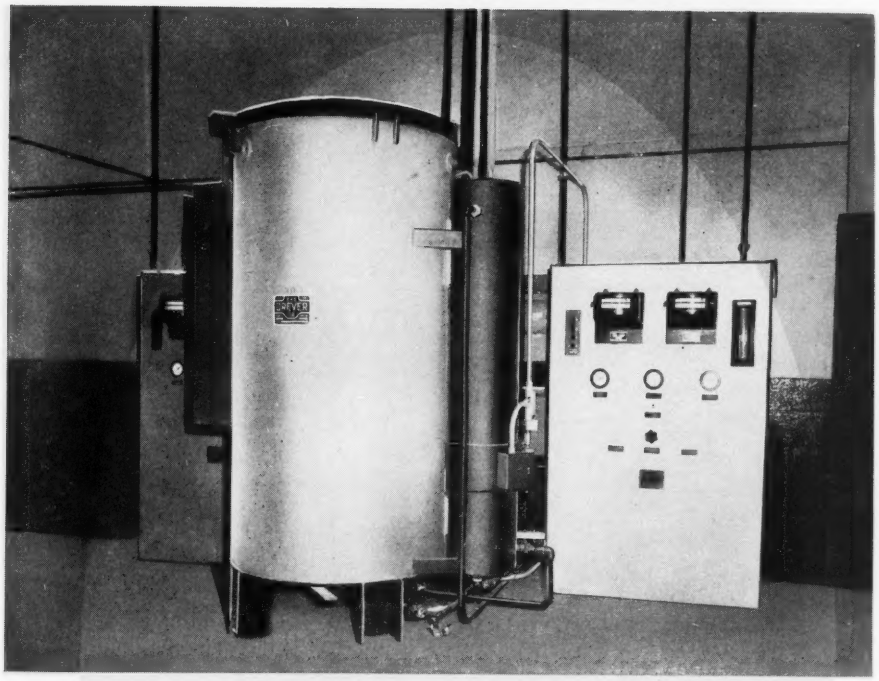
Pittsburgh Fiber Glass yarns are made of exceptionally uniform continuous filaments, twisted and plied for any desired buildup. They are packaged for use with all standard types of serving and braiding machinery.

Pittsburgh yarns have proved their high quality with numerous manufacturers. If you have not yet put them to your tests, you are invited to make arrangements through our executive or district sales offices. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER PG GLASS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY



"Cracked" Ammonia shows tremendous cost saving and unsurpassed performance

1. —Bright Annealing—Stainless Steels, Nickel and Nickel Alloys, Beryllium Copper, Silicon Copper Alloys and Bronzes, and high and low carbon steels.
2. —Clean Hardening—High carbon and high chrome tool steels.
3. —Copper Brazing of all types of ferrous metals.
4. —Sintering of Powdered Metal Parts.
5. —Bright Annealing of Electrical Steels.
6. —Reduction of Metal Oxides.
7. —Atomic Hydrogen Welding.
8. —Radio Tube Sealing.

the Drever

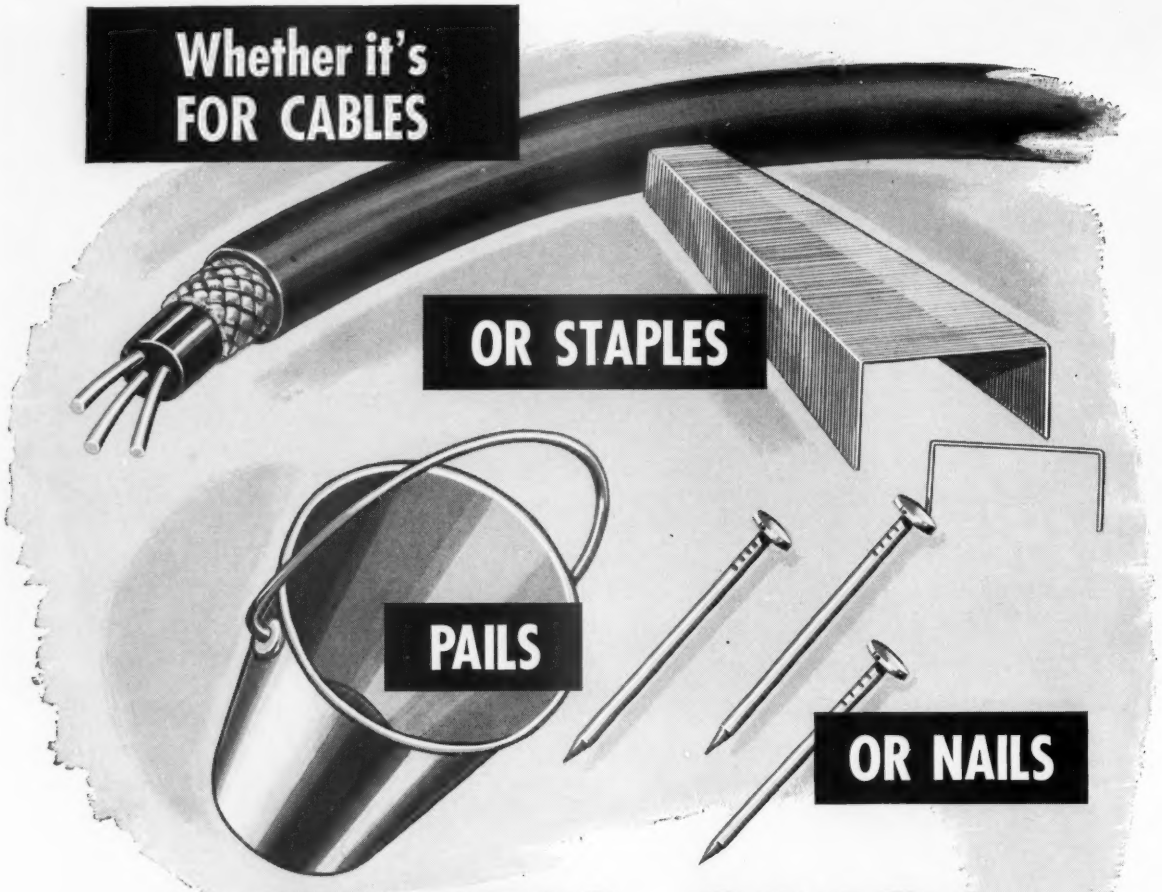
Ammonia Dissociator

produces the ideal protective furnace atmosphere

We can supply COMPLETE STORAGE SYSTEMS for tank car lots of anhydrous ammonia. This reduces the cost of ammonia approximately 75%. *Write for bulletin B-52*

DREVER COMPANY

RED LION ROAD & PHILMONT AVE., BETHAYRES, PA.



SWIFT'S SOAPS

STRATEGIC DISTRIBUTION POINTS throughout the U.S. and Canada can provide prompt, courteous service and immediate delivery on these versatile soaps:

WHITE RIBBON POWDER. White Ribbon Powder in the 41-42° titer range is used by many particular customers as an all-purpose wire drawing compound. Contains 92% anhydrous soap.

#571 HIGH TITER POWDER. A wire drawing powder for the difficult job. A neutral 93% soap powder in the titer range of 45-47° C.

#559 POWDER. For wet drawing of the fine wire products. In solution will remain fluid and completely free flowing at room temperature.

are the efficient lubricant for wire drawing

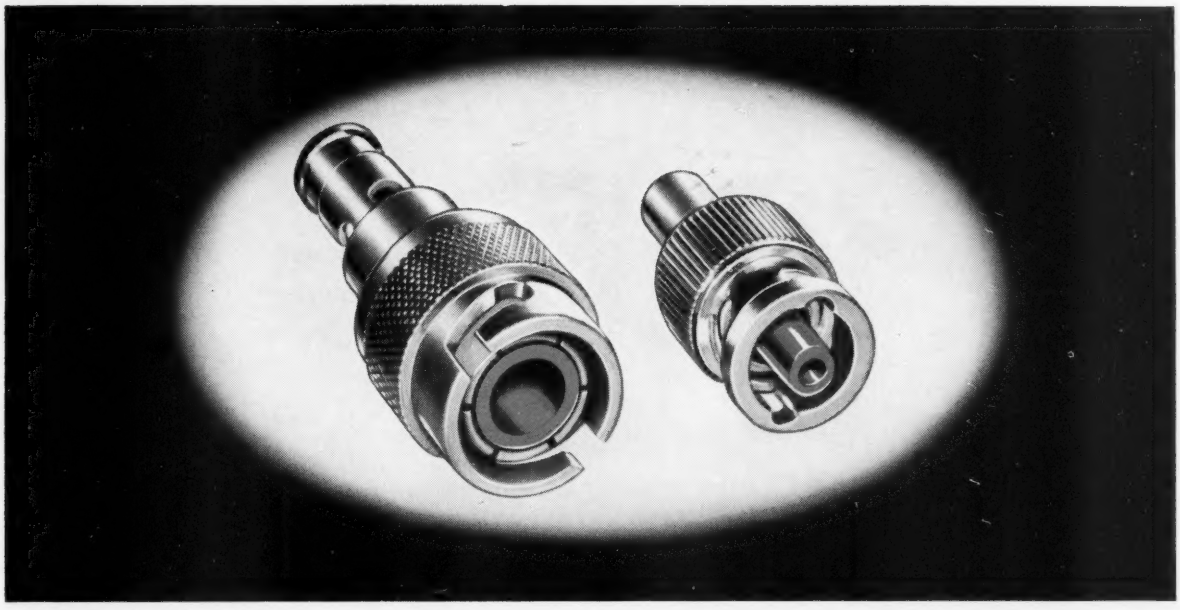
Whether the need be for cables, staples, pails, or nails an efficient wire lubricant is indispensable. That's why Swift's Soaps are constantly being improved to help give you brighter, smoother wire, increased production, and extended die life.

Yes, with any of the products listed at left, you need never compromise the efficiency and speed you purchased in wire drawing equipment. Write for details on these and other SWIFT quality wire lubricants and remember ... ONE TRIAL IS BETTER THAN A THOUSAND CLAIMS.

To Serve Your Industry Better

Swift
101 ST YEAR

SWIFT & COMPANY
SOAP DEPARTMENT
4115 Packers Ave., Chicago 9, Illinois



PRECISION CONNECTORS with KEL-F plastic parts have high RF insulation and dimensional stability. Plastic's high impact and compressive strength permit rough handling without chipping, cracking, or deforming. Zero moisture absorption and anti-adhesive surface prevent formation of conductive residue.

KEL-F® FLUOROCARBON PLASTIC

permits components to operate over a wider temperature range . . . under highly humid and corrosive atmospheres

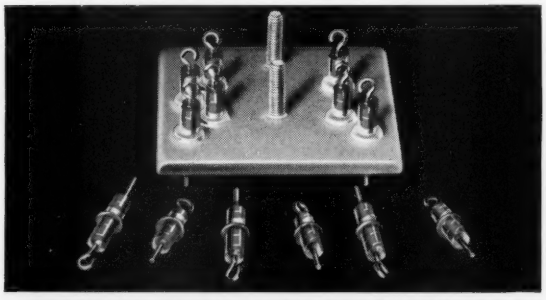
KEL-F plastic's unique combination of properties can help your product meet more rigid performance specifications. Because of the extreme stability of the fluorocarbon plastic molecule, this dense, tough thermoplastic has superior dielectric properties, excellent resistance to corrosive chemicals, outstanding thermal and dimensional stability, and zero moisture absorption.

Molded and extruded parts operate over an extremely wide range of temperatures (—320° F. to 390° F.) . . . are unaffected by humidity or operational vibration. Metal inserts, lugs and contacts are held firmly, forming a hermetic seal.

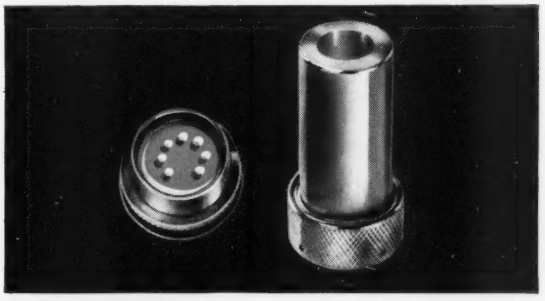
KEL-F plastic is available from Kellogg as a molding material, or in sheets, rods, strips, tubing, film and "spaghetti" from qualified fabricators and molders throughout the country. For further information, write: The M. W. Kellogg Company, Chemical Manufacturing Division, P. O. Box 469, Jersey City 3, N. J.

KELLOGG *Subsidiary of Pullman Incorporated*

® Registered trademark of
The M. W. Kellogg Company for its fluorocarbon products.



HERMETICALLY-SEALED TERMINALS with KEL-F plastic insulation handle high voltage without flash-over or tracking. Won't shrink, swell, age or lose hermetic seal at high and low operating temperatures. Can be used in contact with highly corrosive chemicals.



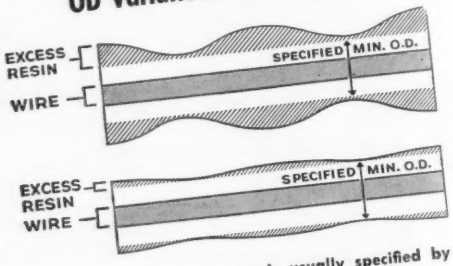
TUBE SOCKETS of tough KEL-F plastic. Hermetic seal defies thermal cycling, aging and humidity. Withstands high shock loads without chipping or cracking insulation. Plastic's high dielectric strength prevents shorting or arc-over at high altitudes.

U.S.I. POLYETHYLENE PROCESSING TIPS

Choose the Right Resin For Polyethylene Wire Coating

Now that polyethylene is being widely accepted as an insulating material for wire and cable, insulated wire manufacturers and plastics producers are working closely together to provide the best insulations at the lowest possible cost. Although the only true test of a given polyethylene resin is a test run followed by a thorough evaluation of the finished wire, there are certain principles that can be used beforehand as guides. For example:

OD Variations Cost Money



Minimum Outside Diameter is usually specified by the wire customer. But a variation in OD above this minimum uses extra quantities of polyethylene resin — and cuts into extruder profits. These variations can be reduced by using resins with consistant flow characteristics as shown in the lower sketch.

Higher Production Rate Means Higher Profit

The faster a machine can be operated, the more money it can make. But higher rates require tighter controls — especially tighter control of resin properties. A resin variation that might still give a satisfactory product at moderate production rates may not be acceptable when the extruding rate is pushed to its limit. Again, consistency of resin properties is of extreme importance.

Final Properties Are All-Important

Deformation under load, stress-cracking, low-temperature brittleness and spark failure must be kept to a minimum in an acceptable wire and cable insulation. Any resin used, no matter what its processing characteristics, must pass these tests.

Why We Recommend PETROTHENE®

Because we make it — of course. But more than that, PETROTHENE does a good job for wire and cable extruders because our manufacturing process does achieve the high consistency processors are looking for. Shipment-to-shipment, bag-to-bag, and cube-to-cube, variations are held to a minimum. This high consistency enables insulated wire manufacturers to operate at highest rates with minimum OD variation when using PETROTHENE electrical grade polyethylene resins.

PETROTHENE resin properties also measure up to end-use standards for deformation under load, stress-crack resistance, low-temperature brittleness and spark failure.

Three Basic Resins Are Available

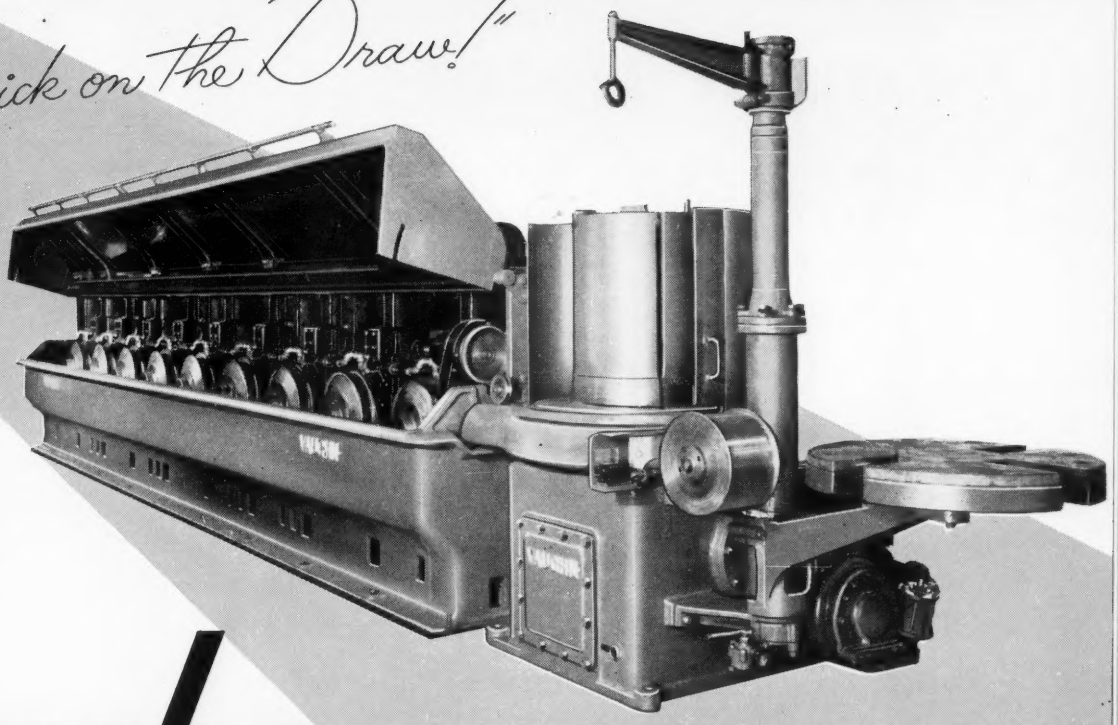
PETROTHENE 300, M.I. = 0.3; PETROTHENE 301, M.I. = 1.0; PETROTHENE 302, M.I. = 2.8. Each available with carbon black, color, JZF antioxidant, and/or non-discoloring antioxidant, compounded to your specifications.

U.S.I. Services

Literature and samples of PETROTHENE electrical grade polyethylene resins are available at your request. U.S.I. Technical Service representatives are also ready to help you with individual processing problems.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

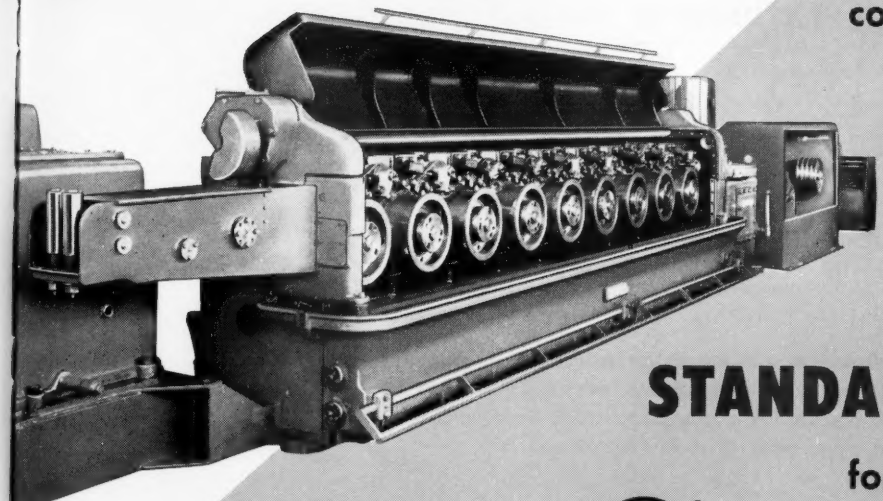
"Quick on the Draw!"



Vaughn® HEAVY TANDEMS

for rapid size reduction of large-diameter rod in copper and alloys

Top efficiency is reached in reducing larger rod diameters with Vaughn slip-type, wet drawing heavy tandems. • Our standard tandems provide high speed reduction of ⅜" diameter aluminum and 5/16" copper to wire • Let us discuss the types and sizes of interest to your operations.



STANDARD TANDEMS

for high-speed drawing of aluminum and copper rod to wire sizes

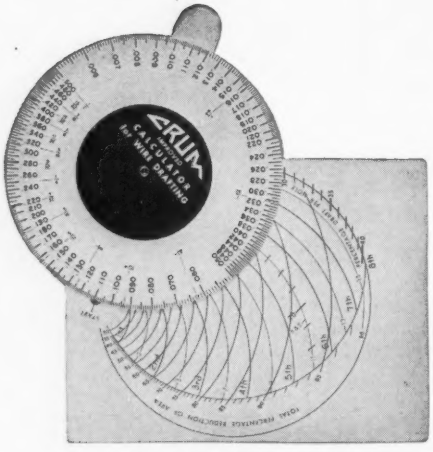
The Vaughn MACHINERY COMPANY • CUYAHOGA FALLS, OHIO • U.S.A.

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

THE NEW and IMPROVED . . .

CRUM CALCULATOR

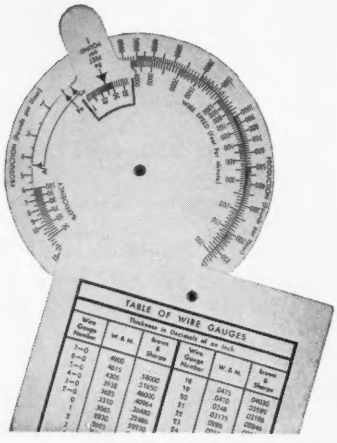
FOR WIRE DRAFTING



Front view of Crum Calculator.

THIS NEW DOUBLE-PURPOSE CALCULATOR WILL:

1. Provide quicker and more accurate information on die sizes and reduction areas;
2. Calculate wire production rates for various speeds and efficiencies.



Reverse view of Crum Calculator.

SOME OTHER FEATURES OF THE CALCULATOR

- Has new scale for more accurate determination of small percentages.
- Gives readings in B & S gauges.
- Intermediate lines provide reductions for 16 holes in one setting.
- New rectangular shaped back for better protection of calculator.
- More legible % draft-per-hole scale.
- Vinyl plastic construction, resistant to wear, warping, dirt, perspiration, wire drawing soaps—can be cleaned.
- Still fits your vest pocket.
- Handy tables of W & M and B & S gauges.
- Feet per pound calculating scale for steel, copper and aluminum wires.
- Durable, accurate, easy to use.

The improved Crum Calculator is worth its weight in gold in time saving —no laborious mathematical calculations necessary when you use it. Instruction sheet with examples accompany each Calculator. You should have one or more in your wire drawing department.

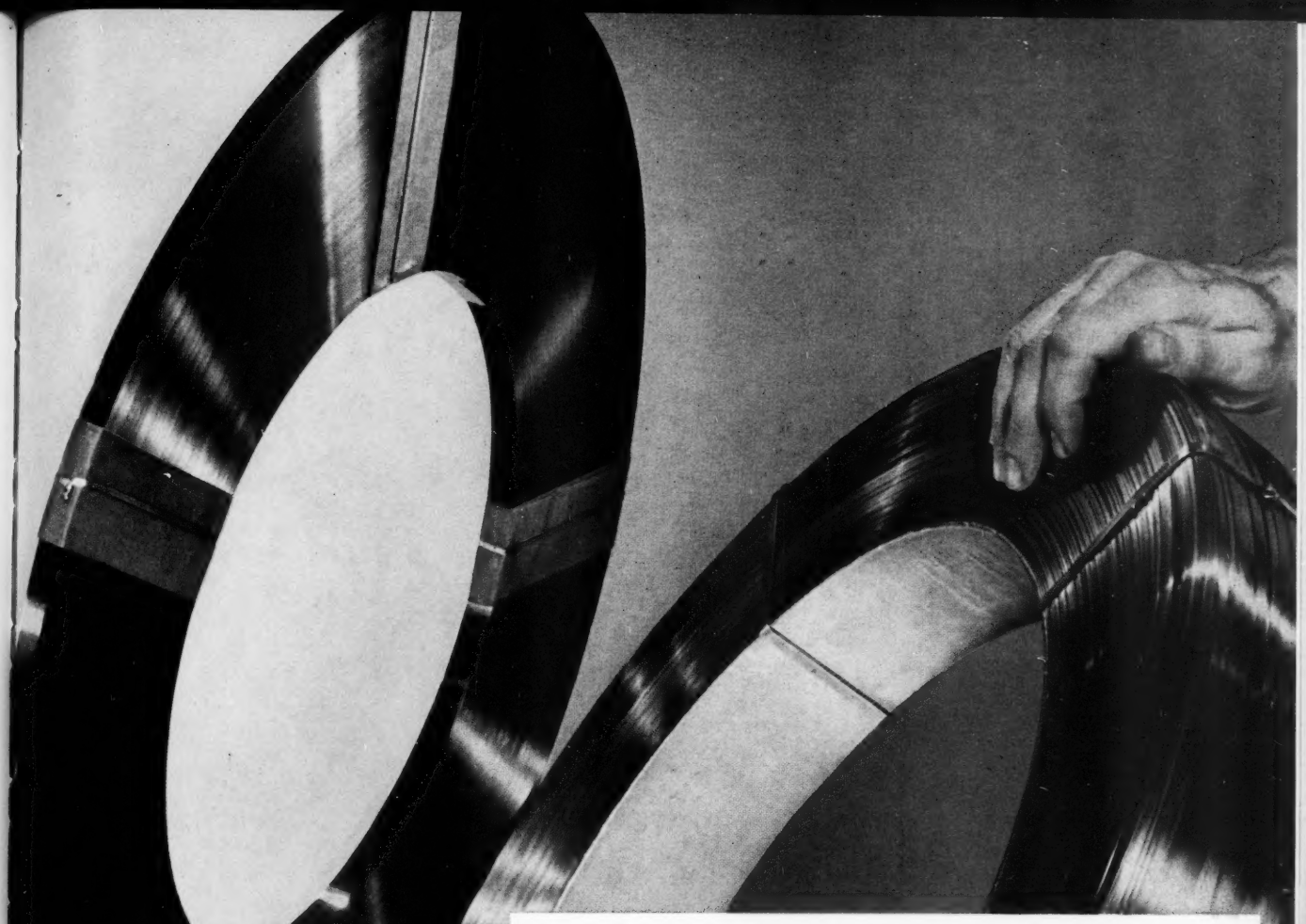
THE PRICE: $5.00 EACH

Send your orders to:

WIRE AND WIRE PRODUCTS

453 MAIN STREET **STAMFORD, CONN.**

(Exclusive distributors)



Nothing finer!

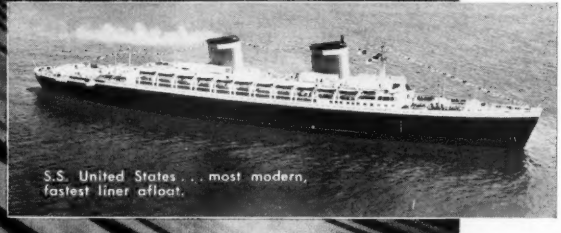
A statement from
a conservative organization:

"Our records show that when a manufacturer once discovers the uniform quality of Roebling flat spring steel, he becomes a steady Roebling customer."

You, too, *pay* for the best spring steel... make sure you *get* it. Specify Roebling. John A. Roebling's Sons Corporation, Trenton 2, N. J.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation



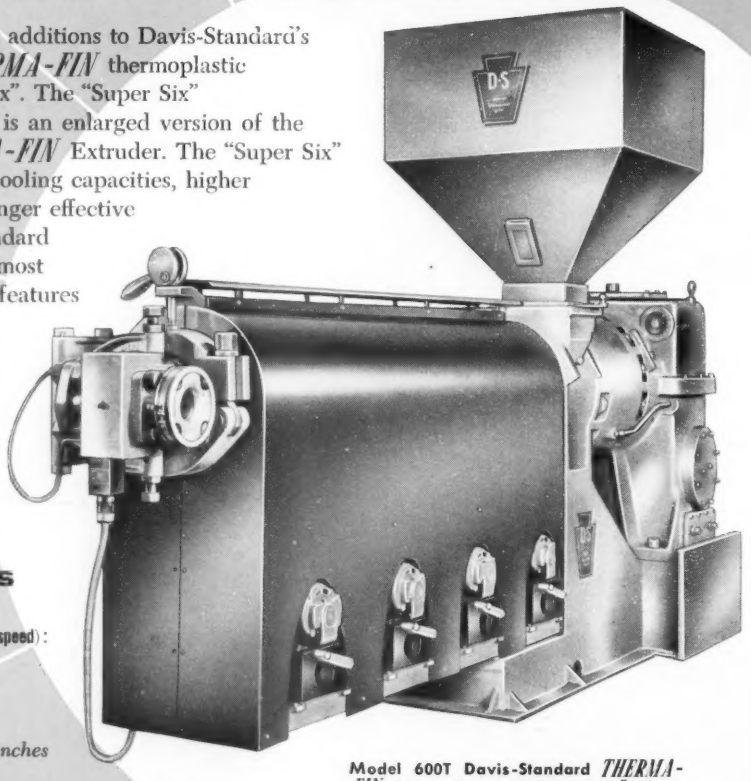
S.S. United States . . . most modern, fastest liner afloat.

ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. & 5 PITTSBURGH ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • ROCHESTER, 1 FLINT ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK

Introducing The "Super Six"

THERMA-FIN EXTRUDER*

One of the more recent additions to Davis-Standard's line of high quality *THERMA-FIN* thermoplastic extruders is the "Super Six". The "Super Six" *THERMA-FIN* Extruder is an enlarged version of the standard 6-inch *THERMA-FIN* Extruder. The "Super Six" has greater heating and cooling capacities, higher rated capacities, and a longer effective screw length than its standard counterpart. Perhaps foremost among the many unique features of the "Super Six" is the excellent temperature control that is provided by Davis-Standard's exclusive *THERMA-FIN* Temperature control system.



Model 600T Davis-Standard *THERMA-FIN* Super Extruder Having 6" Bore. Standard and Super Models Available in 1½", 2", 2½", 3¼", 4½", and 6" Bore Sizes.

SPECIFICATIONS

BORE SIZE: *6 inches*

RATED CAPACITY (at 90 RPM screw speed):

Polyvinyl Chloride – 900 lbs./hr.
Polyethylene – 631 lbs./hr.

EFFECTIVE SCREW LENGTH: *91 inches*

NO. OF BLOWERS: *4*

COOLING CAPACITY PER BLOWER: *920 cu. ft./min.*

TOTAL HEAT RADIATION SURFACE: *14,930 sq. in.*

HEATING CAPACITY:

Head Zone – 3000 W;
Zone 1 – 9500 W;
Zones 2, 3, and 4 – 7000 W each

For catalog sheets or other additional information on THERMA-FIN Extruders, write to:

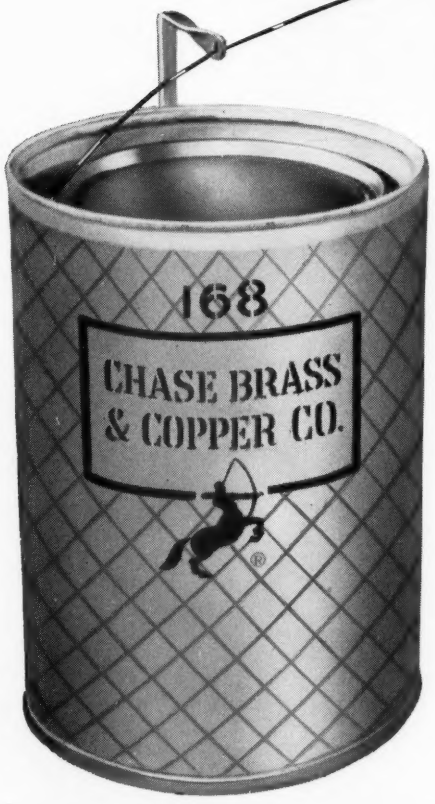
*U. S. Patents Pending

DAVIS-STANDARD
SALES CORPORATION

22 WATER STREET, MYSTIC, CONNECTICUT

SOLE SELLING AGENTS FOR ...THE STANDARD MACHINERY COMPANY, World's Largest Manufacturers of Custom-Built Extruding Machines IN EUROPE AND THE STERLING AREA, CONTACT FINNEY PRESSES LTD., BIRMINGHAM, ENGLAND

CUT Wire forming costs with CHASE® WIRE in new *Payoffpaks*!

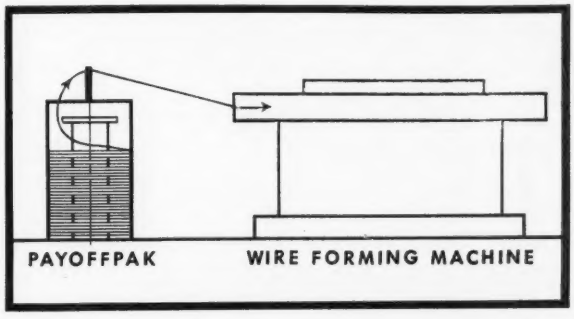


Now, in this compact, easy-to-handle PAYOFFPAK you can get a continuous length of Chase copper alloy wire weighing 400 to 500 pounds!

This new Payoffpak puts an end to frequent set-up of wire-forming machines . . . means *more* continuous, economical operation, *less* costly down time!

You'll like the easy way this Payoffpak handles, the space-saving way it stores . . . and the way it protects the shining surface of Chase copper alloy wire from rough handling in transit and storage.

Ask your Chase Wholesaler or nearest Chase Warehouse about the new Payoffpak the next time you order copper alloy wire.



Chase®

BRASS & COPPER CO.

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The Nation's Headquarters for Brass, Copper & Stainless Steel

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
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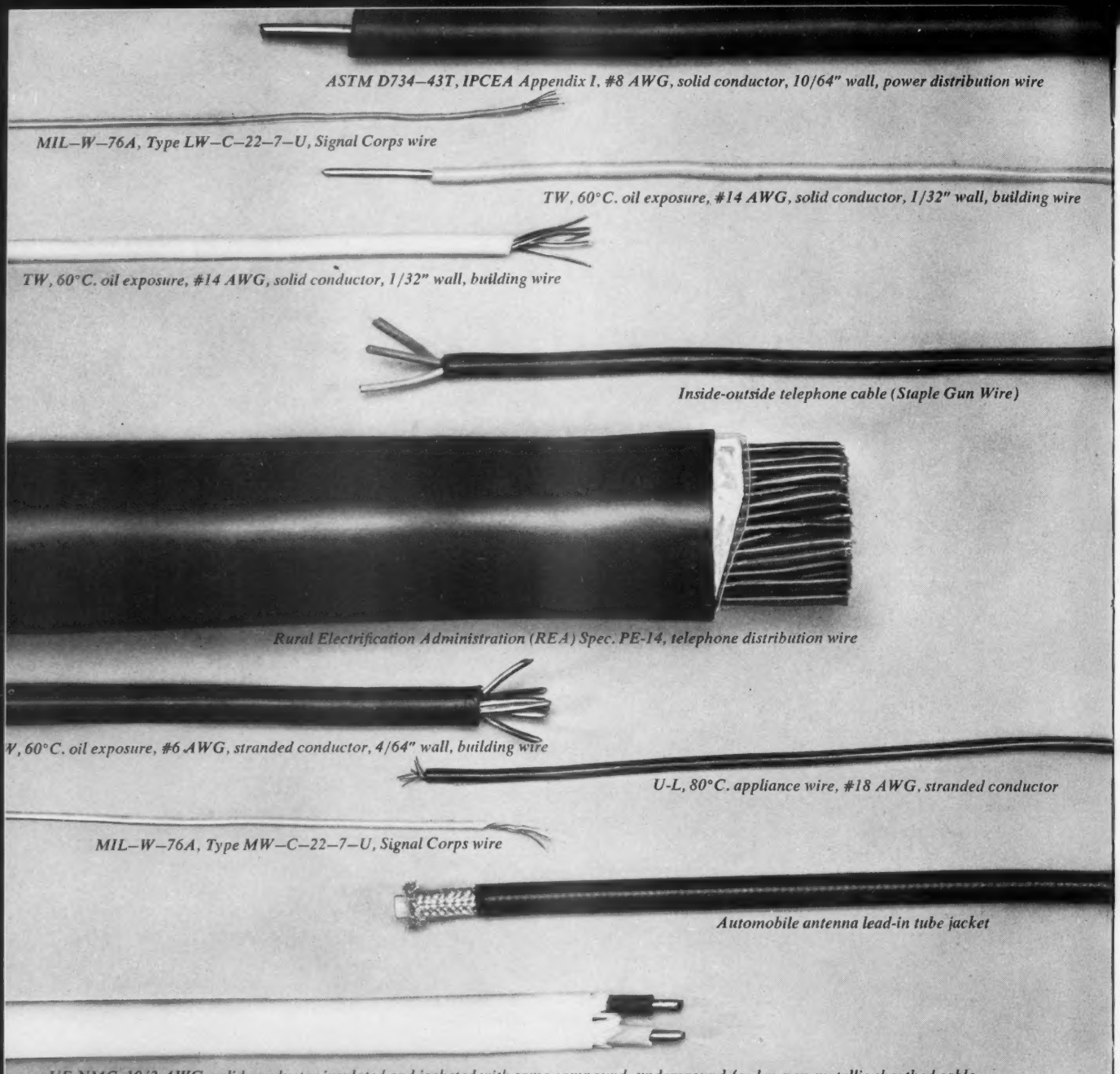
Boston	Cleveland	Grand Rapids	Los Angeles	New Orleans	Providence
Charlotte	Dallas	Houston	Milwaukee	New York	Rochester
	St. Louis	San Francisco	Seattle	Waterbury	


ASTM D734–43T, IPCEA Appendix I, #8 AWG, solid conductor, 10/64" wall, power distribution wire
MIL–W–76A, Type LW–C–22–7–U, Signal Corps wire
TW, 60°C. oil exposure, #14 AWG, solid conductor, 1/32" wall, building wire
TW, 60°C. oil exposure, #14 AWG, solid conductor, 1/32" wall, building wire
Inside-outside telephone cable (Staple Gun Wire)
Rural Electrification Administration (REA) Spec. PE-14, telephone distribution wire
W, 60°C. oil exposure, #6 AWG, stranded conductor, 4/64" wall, building wire
U-L, 80°C. appliance wire, #18 AWG, stranded conductor
MIL–W–76A, Type MW–C–22–7–U, Signal Corps wire
Automobile antenna lead-in tube jacket
UF-NMC, 10/2 AWG, solid conductor insulated and jacketed with same compound, underground-feeder, non-metallic sheathed cable

One vinyl compound for all–versatile OPALON* 1038

Remarkable physical and electrical properties qualify OPALON 1038 for scores of uses

A single insulating and jacketing compound now gives outstanding performance on a wider range of wire and cable applications than has ever been practical before. It is available to you *without* a premium price!

A unique combination of high insulating efficiency, excellent heat resistance and extreme toughness is responsible for the all-purpose versatility of Monsanto Opalon 1038 vinyl compound.

Opalon 1038 is widely used for U-L Type T, TW and exposure to oil at 60° C., as well as for U-L 80° C. appliance wire.

To simplify inventory and stock control, the same compound is recommended for both primary insulation and jacket in UF-NMC, underground feeder and non-metallic sheathed cable. It is especially good for machine tool wiring.

Rugged physical properties, including weather resistance and flame resistance, also qualify Opalon 1038 for insulating large-sized building wire (#6 AWG and over) and for cable jacketing.

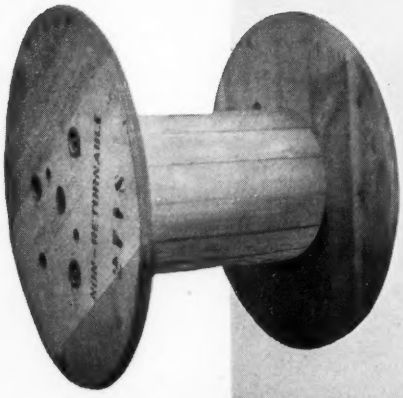
All these applications have won appropriate recognitions from U-L, IPCEA, REA and Government agencies. For data sheets and complete information, write Monsanto Chemical Company, Plastics Division, Room 1121, Springfield 2, Mass.

MONSANTO

*OPALON: REG. U. S. PAT. OFF.

SAVE your company more!!!

SERVE your customers better!!!



the **NARCO**
NON-RETURNABLE

An expendable package — light in weight, soundly engineered and **LOW IN COST.** Save costly freight, expensive reel maintenance, valuable plant space. Serve without the inconvenience and expense of deposits to yourself **and** your customer.

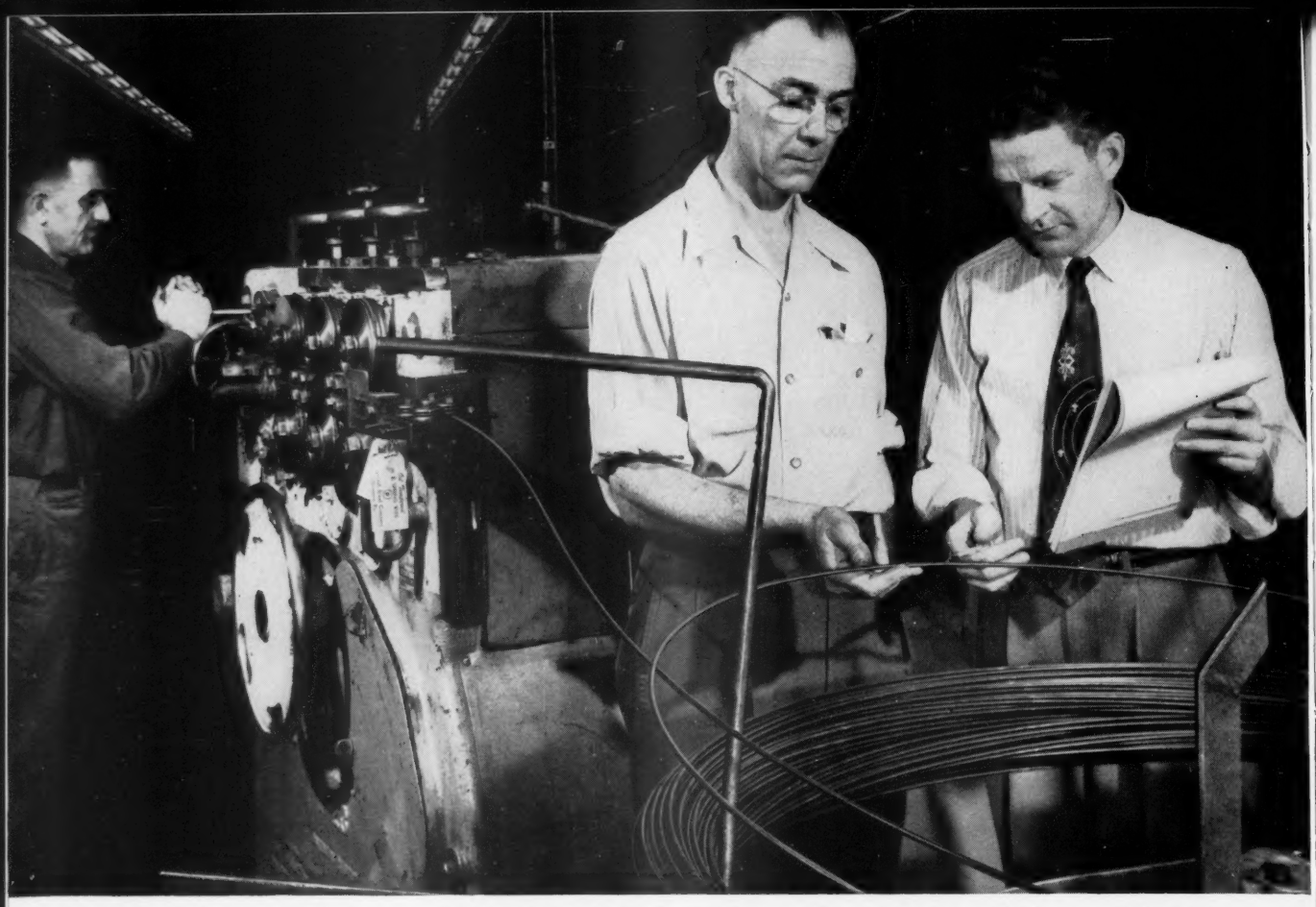
the **NARCO**
METAL BOUND

A returnable package — lasts **FOUR TO SIX TIMES** as long as all wood reels. For applications where a non-returnable cannot be used. This durable reel requires no maintenance and is lighter than comparable all wood reels. Superior service and satisfied customers.

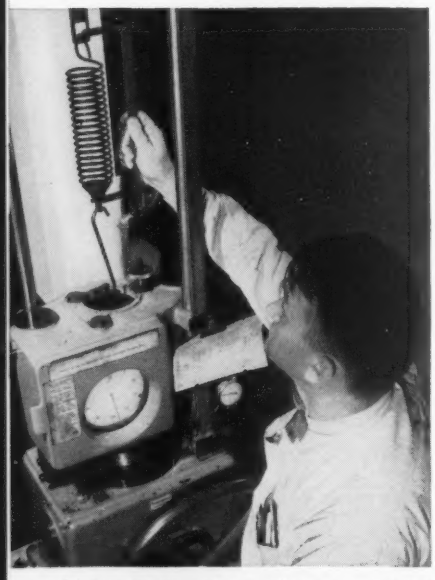
Remember — THESE ARE PRODUCTS OF THE MOST MODERN UP-TO-DATE REEL PLANT IN THE WORLD (MANUFACTURED BY A COMPANY WITH NEARLY 50 YEARS EXPERIENCE); A BACKGROUND OF EXHAUSTIVE TESTING AND RESEARCH IN THE LABORATORY AND THE FIELD.

NORTH ANSON REEL CO.

NORTH ANSON, MAINE . . . *Makers of Reels Since 1909*



Walter Casler, left foreground, foreman of automatic production, and Les Danner, assistant purchasing agent, inspect Pittsburgh Steel Company high-carbon, oil-tempered MB wire at Raymond Manufacturing Company plant at Corry, Pa.



Peter Dubrosky, assistant to chief inspector at Raymond Manufacturing Co., Corry, Pa., plant, measures extension of a Westinghouse Laundromat tub spring during a quality control inspection.

You Own 1,000 Springs

Pittsburgh steel wire used by Raymond Manufacturing Co. in long-lasting Westinghouse Laundromat® Springs

One thousand springs of all sizes, shapes and functions are the property of the average home owner. And if the family car is included, the figure would be over 1,600.

Count the many springs in one popular model refrigerator. Add the tiny springs that control thermostats in electric or gas ranges. Throw in the three rugged springs that suspend the automatic washer's tub (if it's a Westinghouse Laundromat®).

Springs serve every day in dozens of ways—silently, surely and safely. Making them is a job requiring top-flight design, best quality materials, the latest coiling machines, plenty of experience and know-how.

A case in point—take one of the nation's oldest and largest spring makers, Raymond Manufacturing Company, a division of Associated Spring Corporation.

• **Three Vital Springs**—Raymond helped develop and now makes three vital springs which support the tub unit in Westinghouse Electric Corporation's Laundromat. A major supplier of the .207 oil-tempered MB wire from which the springs are coiled are Pittsburgh Steel's wire mills in Monessen, Pa.

Raymond meets Westinghouse's rigid specifications precisely. And Raymond officials give Pittsburgh wire credit for a strong assist.

Les Danner, Raymond's assistant purchasing agent who buys 2,200

sizes and types of materials at Corry, Pa. says:

"I'm fully sold on the quality of Pittsburgh Steel's wire. Pittsburgh Steel has become a major supplier for us because its quality is tops."

Walter Casler, foreman in the automatic production department, has 26 years of experience behind him when he says:

• **"Best I've Ever Seen"**—"I don't ever recall a rejection of Pittsburgh Steel's wire for quality. Pittsburgh's oil-tempered, especially, is some of the best wire I've ever seen."

Raymond must depend on the quality of the wire when making the Laundromat springs. These springs are coiled extension springs, tapered at one end to a bell shape. Two of the three springs on each tub are 6⅜ inches long, 2½ inches O.D., and weigh one pound, seven ounces each. The third spring is smaller.

The two larger springs must be capable of supporting 52 pounds at 9½" extension. At 11⅞ inches, they must carry 78 pounds. Because the three springs are the main support of the tub unit in the Laundromat, they must be both load-supporting and vibrating springs.

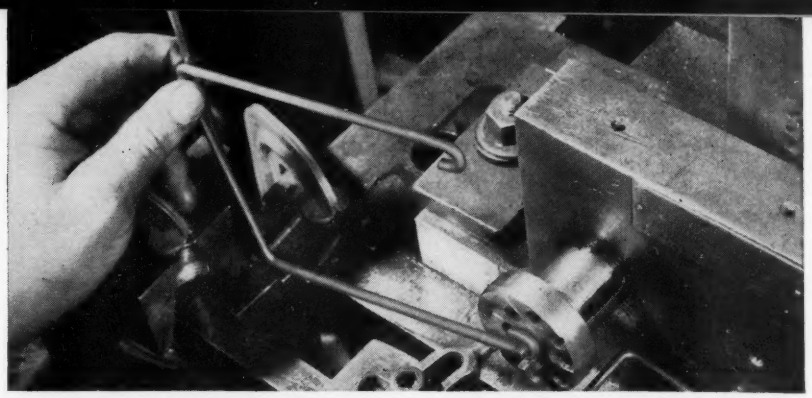
• **Surface Quality Counts**—If any of the three springs fails in use, the cost would be the expense of a complete dismantling to make repairs. That's why Raymond has installed a number of quality control inspections and tests throughout the production process.

Pittsburgh Steel also is Raymond's major supplier of hard-drawn, high-carbon MB wire. Pittsburgh Steel ships to Raymond tons of basic, bright, low carbon wire as well.

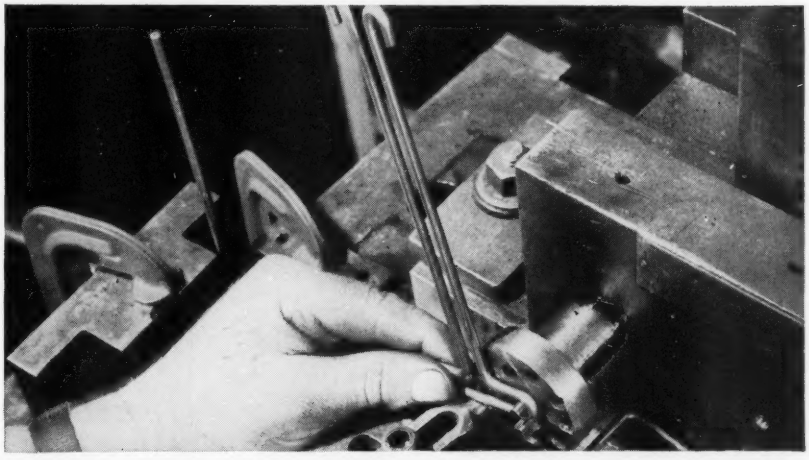
Raymond's experience with Pittsburgh Steel wire has been duplicated in many other plants across the nation.

Pittsburgh Steel's range of wire products can fit quickly, profitably into your operations. Its 50 years of experience in quality wire-making, its willingness to give service, its own extensive facilities and those of its subsidiary, Johnson Steel & Wire Company, can be the answer to your wire problem.

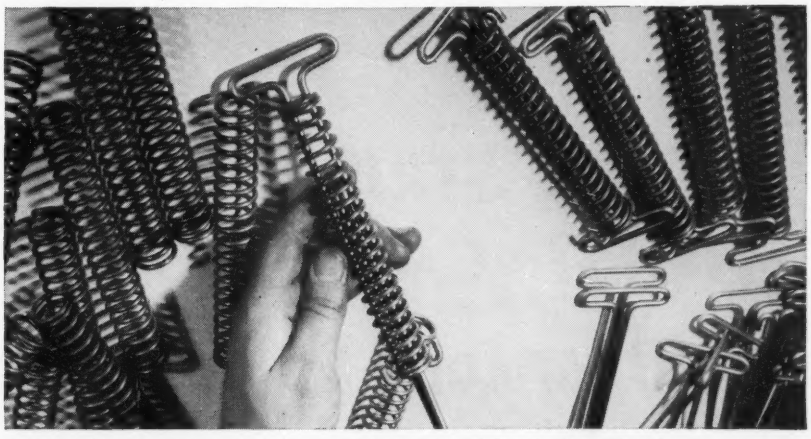
There's a national sales staff at your disposal. Contact any member of it today.



1. An 18$\frac{5}{16}$ inch piece of Pittsburgh Steel Company's .162 bright low carbon basic wire is hook wound on either end before being formed into a drawbar for extension spring on boat trailer.



2. Fourth and final forming operation in making drawbar is to form the loop.



3. Drawbars are inserted in opposite ends of 5$\frac{7}{8}$ inch spring to form unit. Spring is made from .105 hard drawn wire.

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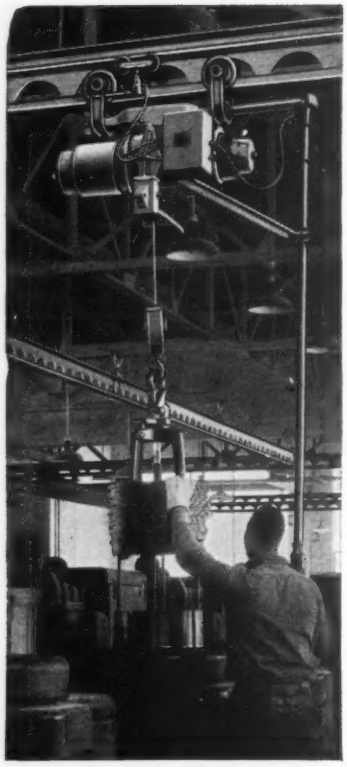

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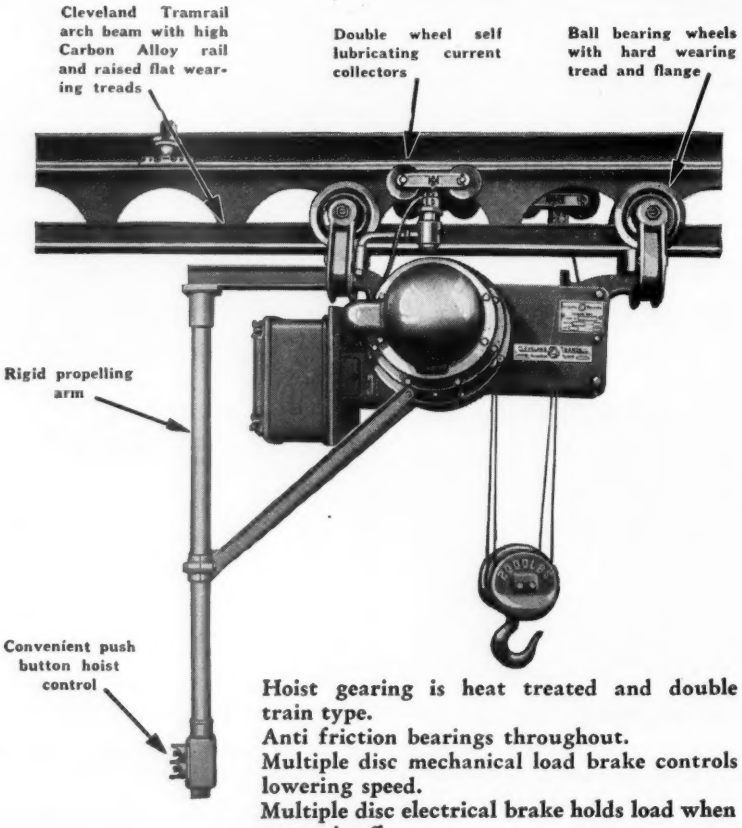
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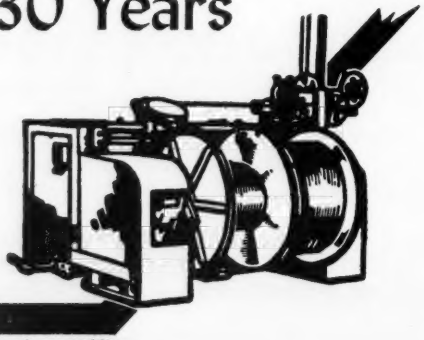

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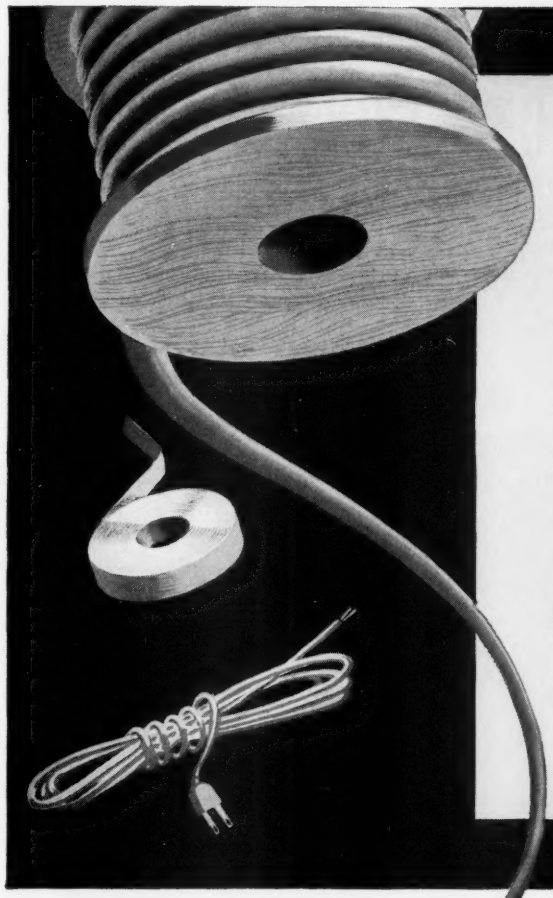

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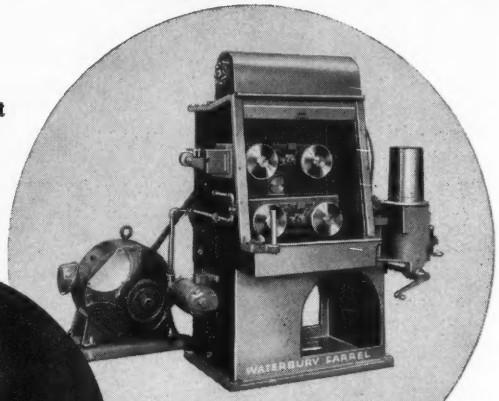
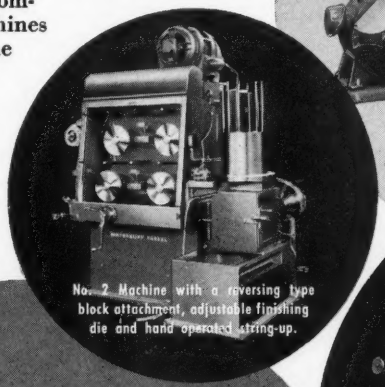
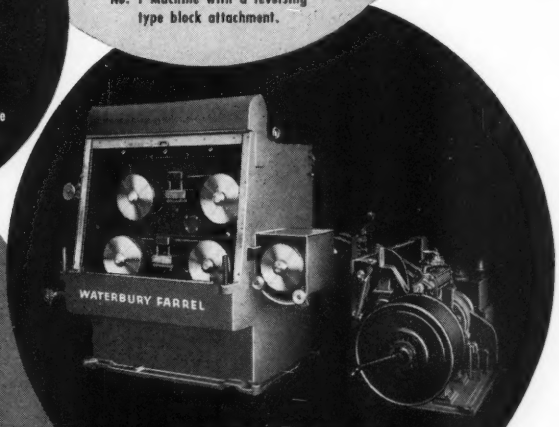


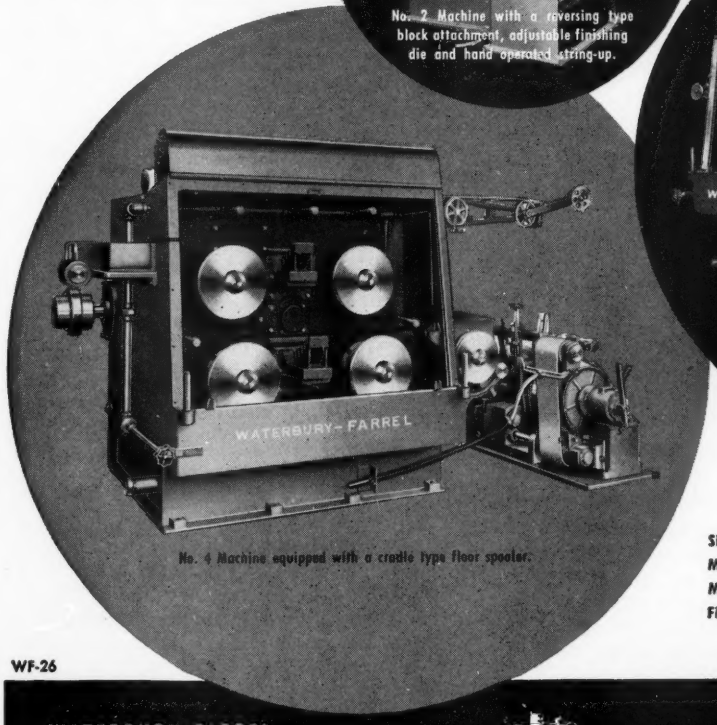
No. 1 Machine with a reversing type block attachment.



No. 2 Machine with a reversing type block attachment, adjustable finishing die and hand operated string-up.



No. 3 Machine with a floor spooler.



No. 4 Machine equipped with a cradle type floor spooler.

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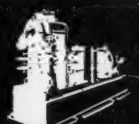
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The Wire Outlook

Economic activity for the first quarter is estimated to have been just under the 400 billion dollar mark, a little higher than the last quarter of 1955 and 6% higher than a year ago, when a rate of 370 billions was reported.

Auto sales were off 13.7% and probably will run about 6.5 million units for the year. Residential building has slowed somewhat, too. Both these activities are reacting to the effect of tightened credit. Their declines are somewhat offset by increased business spending for new plant and equipment and by increased public works outlays. The highway construction program, which will be accelerated, will help to keep business at satisfactory levels.

Steel production carries on at or near capacity and employment remains better than "normal". It is quite probable that steel wages will go up sharply when the present contracts expire at the end of June, which will necessitate higher prices all along the line. If industry resists the new demands, strikes are almost certain to affect steel shipments, which accounts for some inventory building. Apart from strikes, however, due to vacations and other factors, business will be a little slower through the Summer.

An annual demand for increases in wages has become a habit with the unions. The trend is definitely inflationary, but as long as it is moderate, it has been considered a "controlled inflation" of not too great consequence. Many businessmen have tolerated inflation as unavoidable and it would seem that a majority of politicians favor it because rising prices always give the public a sense of prosperity, even though it is false and empty of results in the long run.

Government, too, is avoiding the long overdue tax reforms and reductions, for the reason, it feels, that the increased spending money would tend toward inflation. This is a carry-over of New Deal thinking. In our humble opinion, it is a lot safer and sounder to have the ultimate consumer doing the buying, rather than the government. There is vast room for improvement in the thinking of our economic advisors along these lines.

Barring strikes, steel will be plentiful. The copper supply situation continues to improve, but it is interesting to note that in May Rhodesian copper prices were cut to around 43 cents. Copper, however, is more likely to advance than not, as new labor contracts are in the offing, with wages expected to go only one way—up. Actually, the nation's primary production of copper is at a three-year high.

Merchant wire demand has not been as good as hoped for this Spring, since farmers have been buying only what they can get by with. Jobber stocks are high, although some late reports indicate a slight pick-up. Manufacturers' wire, on the other hand, is enjoying strong markets in most areas. Wire rods have become fairly tight as a consequence. Wire for fasteners is moving very well. Some high carbon specialty wire manufacturers would welcome additional orders. Spring wire is selling well and welded wire fabric, of course, continues to be big business. The demand for domestic wire nails, in spite of foreign competition, is well ahead of last year. One Southern manufacturer, because of building nail imports, has had to reschedule nail production to special non-competitive types, but adds that there is much dissatisfaction with the foreign-made nails, due to the fact that they are heavily greased and the heads break off with annoying frequency.

Continued high levels of demand are seen for the electric wire and cable industry, partly due to large annual population increments and partly due to the large residential and industrial building programs. The use of aluminum in electrical applications continues to grow, somewhat because of price, but also because of availability. Copper is much the better conductor, but Old Man Economics has a way of dictating what shall be used where substitutions are possible.

Full employment, in itself, will help to keep the levels of business activity high. The long-range outlook continues to be favorable and businessmen, in shaping their policies for the future, appear to be basing their planning on the prospect and expectation that our population growth will make it necessary to feed, house, clothe and transport many new citizens each year.

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Vol. 31 June, 1956 No. 6

Fourdrinier Wire Weaving

by William A. Kools
Neenah, Wisconsin

The author has developed and patented an improved method of weaving twill Fourdrinier wire cloth, in which, instead of the conventional one-up, two-down cloth, there is a regulation of the relative tensions of the lower warp wires to produce a symmetrical, uniform crimp that will not have the same tendency to mark the paper web, and furthermore will increase wire life.

The Fourdrinier wire weaving industry is a highly specialized section of the wire industry and caters principally to pulp and paper mills. Fourdrinier wires are used by these mills in the forming section of the paper machine. These wires are custom-made since paper machine wires vary in width and length requirements and the various papers require fine or coarse mesh wires depending upon the type of paper to be produced. Paper machine Fourdrinier wires range from approximately 6 feet to 25 feet in width and from 40 feet to 180 feet in length. Wire mesh may range from 40 to 100 mesh. Phosphor bronze warp and brass shute wires are most commonly used in the manufacture of this type of wire cloth and the greatest care in selecting the proper composition, drawing and annealing is required since the warp wires are subject to tension and bending stresses as well as to considerable wear in their contact with suction boxes, rolls and doctors. Too soft a warp wire will wear down prematurely and too hard a warp wire will cause early cracking, so that the makers of Fourdrinier wire cloth must exercise the greatest possible control in the drawing and annealing processes. Various weaves are produced to suit the mill requirements, the most common being the one-up-two-down, twill weave. Other mesh consists of plain weave, cable and triple chain weaves. Fourdrinier wires have a relative short life, ranging from two weeks to six weeks, with perhaps an average life of three weeks.

★ ★ ★

Figure No. 1 shows a heavy duty Fourdrinier wire weaving loom.

★ ★ ★

Looms of this type are available

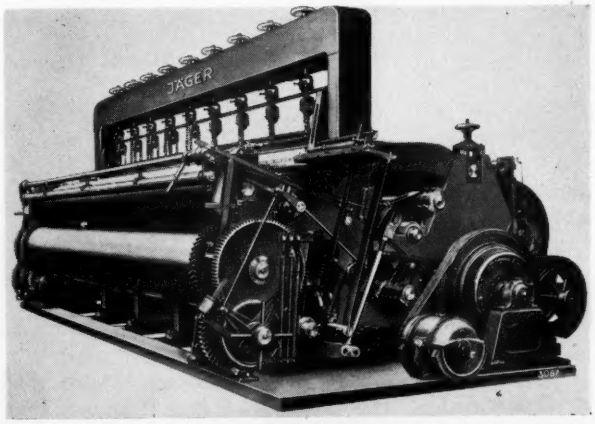

Fig. No. 1 Fourdrinier Wire Weaving Loom.

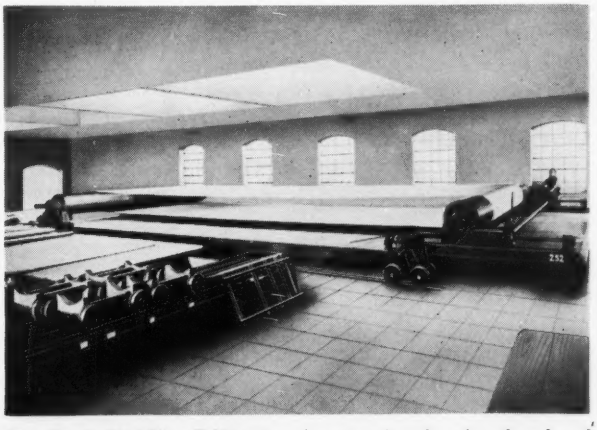

Fig. No. 2 Stretching Table.

in widths up to 26 feet. They are precision built machines, usually equipped with ball and roller bearings, helical gearing and ground roll surfaces. In the weaving process the wire cloth is subjected to the most minute inspection by the weaver since the wire cloth must have a perfect surface to prevent marking the wet sheet of paper as it is being formed on the paper machine. When the weaving process has been completed the wire is placed on an inspection table and is again subjected to a most careful examination.

★ ★ ★

The next step in finishing the Fourdrinier wire is to form it into an endless belt. The current practice is to silver solder, or weld the ends together, although a small percentage of wires are hand seamed. The seaming process is most commonly accomplished by a semi-automatic strip laying and brazing unit. A silver solder clad, phosphor bronze strip, a few thousandths of an inch in thickness and the approximate width equalling the thickness of the wire cloth, is placed between the two ends of the wire cloth and the correct amount of heat and pressure applied to form a perfectly brazed joint. Other operations in preparation of the seaming process include cutting the wire cloth to proper length, cutting back the pickets to the proper length and applying flux. After the brazing process a complete inspection is made of the seam on the top and bottom side of the wire.

★ ★ ★

The wire is next placed on a two-roll inspection and stretching machine. These machines are equipped with dual drives, one to run the wire forward and backward, and the other to stretch the cloth so that the wire cloth and seam will lay smoothly. A typical stretching machine is shown in Figure No. 2.

★ ★ ★

Another process available to paper mills requiring a smoother top surface of the Fourdrinier wire to prevent or reduce wire marking in the sheet of paper is to reduce the top knuckle of the crimp by an abrasive process. This operation, though practical in reducing the wire marking, seriously affects wire life, in some cases lowering the life by as much as 25%. Other wires are rolled or calendered to smoothen the surface. These processes increase the cost by approximately 5%.

★ ★ ★

A recent invention, U. S. Patent No. 2,728,358, points the way to improving the characteristics of twill wire cloth intended for use as the forming wire of a Fourdrinier paper machine.

★ ★ ★

There are many considerations which enter into the selection of a particular type and mesh of weave in the Fourdrinier wire, two of the more important ones being the tendency of the wire to leave a mark upon the paper web, and the useful life of the wire. A majority of the Fourdrinier wires used today are of the twill weave, and although several types of twill have been experimented with from time to time, the one-up-two-down twill has become, for practical purposes, the standard twill for Fourdrinier wires. The Fourdrinier wire which is entrained around a series of rolls in the forming section of the Fourdrinier machine, with the long crimp or knuckle of the warp wire disposed to contact the rolls, suction boxes, etc of the machine. Theoretically, this places a greater length of the warp wires in contact with the rolls, and other conditions being equal, would increase the life of a twill woven wire over that of the plain weave. As a matter of actual fact, however, the methods of weaving twill wire cloth which prevail in the industry produce in the warp wires of the cloth an unsymmetrical or non-uniform long crimp which is deeper at one end than at the other, and which therefore contacts the rolls and suction boxes of the paper machine along only a portion of its length, called the "heel". Accordingly, the principal object of the invention is to provide a method of weaving twill wire cloth which will produce a symmetrical and uniform crimp in the first instance, thereby increasing the life of Fourdrinier wires and reducing their paper-marking tendencies without increasing their cost.

★ ★ ★

Briefly, the method of invention contemplates a regulation of the relative tensions of the lower warp wires, that is, those which are being formed into the long crimp, during the beat-up of the shute wire into the fell of the cloth. It has been discovered that if, during the beat-up of the shute wire, a greater tension is maintained in that set of lower warp wires which formed the top shed for the insertion of the next previous shute wire, than in the remaining lower warp wires, the "heel" which occurs in the long crimp of twill cloth woven in accordance with prevailing practice, can be eliminated, and a symmetrical, uniform bottom crimp or knuckle produced. As a consequence the shute wire also takes on a more nearly symmetrical shape and a more adequate paper support is provided by levelling both warp and shute crimp wires and consequently lowering the crests and raising the valleys for a more nearly perfect forming wire. An increase of wire life in the range of 10% can be expected by this new method of weaving.

★ ★ ★

The invention will be better understood by reference to the accompanying drawings. Figure No. 3 is a magnified longitudinal cross-section of a short segment of one-up-two-down twill wire cloth woven by the prevailing methods and illustrating the unsymmetrical long crimp of the warp wire.

FIG. 3

Figure No. 4 is a similar cross section of a segment of twill wire cloth produced in accordance with the method of invention showing a full symmetrical crimp.

FIG. 4

Figure No. 5 shows the three positions of a heddle in forming the crimp. In the conventional method of weaving one-up-two-down twill wire cloth, the heddle position in forming the long crimp portion is the same, that is, it remains in the extreme downward position on the second and third cycle causing the aforementioned unsymmetrical sloping long crimp.

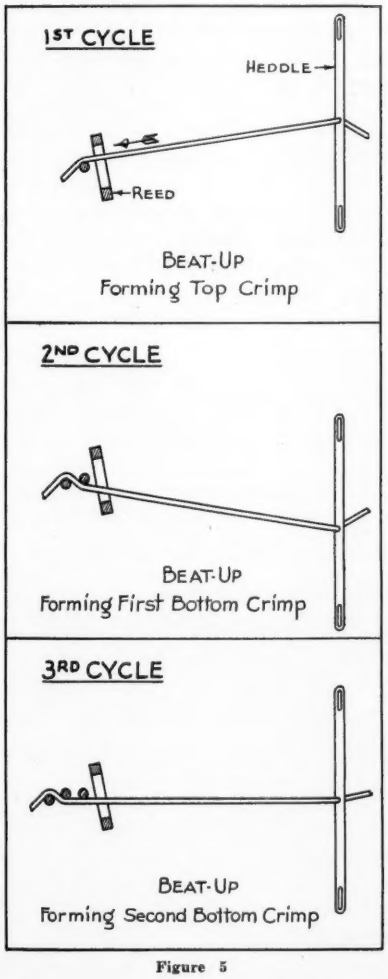

Figure 5

This condition is aggravated in tightly woven cloth. Figure No. 5 shows the heddle positions at the time of beat-up of the three shute wires in a cycle of forming the one-up-two-down twill wire cloth in accordance with the patented idea. The first cycle shows the heddle position at the time of beat-up in forming the top crimp. In the second cycle the heddle has moved to its downward position for placing the second shute wire. At the time of beat-up of the third shute wire, the heddle has been allowed to occupy an intermediate position releasing some of the tension in the warp wire and thereby levelling the bottom crimp. The relative tension in top and bottom sheds at top, bottom and intermediate positions can be adjusted for the different mesh of cloth and beat-up to be produced, to give a symmetrical crimp for a more perfect paper forming basis and for longer wire life. The motion from upper, to lower, to intermediate position takes place in the proper sequence on all three sheds required in weaving a one-up-two-down twill.

★ ★ ★

A modified shedding arrangement for achieving the same overall result has also been developed and is covered by the aforementioned patent. In this case, as before, the shed is formed by raising one set of warp wires, while maintaining the remaining sets in a depressed position to constitute the bottom shed for the passage of the shuttle. However, after the shuttle is passed, and as the lay moves forward to beat the shute wire into the fell of the cloth, one of the lower sets of warp wires is depressed still farther, while the other set is raised above the position which it occupied when the loom picked. In this manner, as with the first mentioned method, a greater tension is maintained in the lower set of warp wires of the split bottom shed, but the tension differential which can be achieved is greater than before, other variable factors remaining constant. In this case, however, it is essential that the splitting of the bottom shed take place after the lay begins its forward motion in order to provide the necessary clearance for further depression of the lower wires of the split bottom shed.

★ ★ ★

The difference between the results of the methods of invention and the result of the prevailing method will be apparent from Figures 3 and 4. Figure 3 shows the conformation of a warp wire in a segment of one-up-two-down twill wire cloth woven by the prevailing methods. It is evident that the long bottom crimp or knuckle is uneven, having a deeper or sharper bend or "heel" in the first or leading portion of the knuckle, i. e., the bend which is formed by the beat-up of the first shute wire under which the warp passes. On the beat-up of the succeeding shute wire, the brunt of the force of beating up the shute wire is borne by the adjacent warp wires, with the result that the final bend of the lower crimp is less pronounced.

★ ★ ★

It will be apparent that insofar as Fourdrinier wire is concerned, the capabilities of the twill weave for greater wire life cannot be fully realized with the twill wires woven by prevailing methods, without subsequent treatment, because the wear on the long crimp cannot be evenly distributed. Furthermore, the short top crimp as well as the shute crimp is more pronounced, with the result that there is a greater tendency to mark the paper than is the case with a Fourdrinier wire woven in accordance with the present invention shown in Figure 4. In the latter it will be noted that the long bottom crimp of the bottom warp wire is symmetrical and parallel with the plane of the cloth, there being no "heel" as in the case with the conventional twill wire. Other factors being equal, therefore, the life of a Fourdrinier wire woven in accordance with the method of the invention may be increased substantially over the conventional wire and will as a corollary of the uniform bottom crimp, exhibit a lesser tendency to mark the paper web.

Semi-Annual Meeting of the Board of Directors of the Wire Association

Following due notice to the Board members, this meeting was held at the Statler Hotel in New York City on April 20, 1956.

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President Leslie C. Whitney opened the meeting and called the roll at 10 A.M. Those responding were **R. E. Brown, F. M. Crapo, L. C. Crewe, Jr., A. B. Dove, J. E. Flood, T. M. Girdler, Jr., C. L. McGowan, E. R. Potter, R. B. Roth, B. J. Sirois, C. H. Williams, Jr., G. B. Wood, Jr.** and **R. S. Worth.** Others in attendance included **D. M. Schmid, L. D. Seymour, J. E. Donnellan, E. D. Sickels, H. W. Biskeborn** and **Mrs. R. S. Spengel.**

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Mr. Brown read the minutes of the previous meeting and presented the financial report on the Association's receipts and disbursements from October 1, 1955 to April 1, 1956. Both were approved as presented.

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Mr. Dove, Chairman of the By-Laws Revision Committee, presented the proposed revisions, which were discussed, resulting in suggestions for redrafting several items. These further changes are to be placed before the Board at the Fall meeting and will be put to a mail ballot if approved by the directors.

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Mr. Brown presented a report on the program of the Midwest Regional Meeting, May 24 and 25, in Kansas City, for **Stewart S. Gray,** who was unable to be present. For this meeting four technical papers, three plant inspection tours and a banquet are scheduled.

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Mr. Potter gave a summary of the program scheduled for the Pacific Coast Regional Meeting in Los Angeles on June 8, at which two plant tours, a banquet and an after dinner talk by **L. J. Soracco,** District Manager of Sales, **Bethlehem Pacific Coast Steel Corporation,** are planned.

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Mr. Williams gave a summary of the program prepared for the Annual Convention to be held in Pittsburgh from October 28 through November 1. In this connection he read a list of the technical papers to be delivered at the Ferrous Division sessions. Mr. Biskeborn made a similar report on the Non-Ferrous Division program. The reports showed that both of the programs are now complete, with a couple of standby papers available for emergencies. The matter of plant visitations was discussed, that for the steel men being settled and some for non-ferrous men yet to be confirmed.

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The Smoker-Dinner Show was reported on by Mr. Brown for **E. J. Hubbard,** Entertainment Chairman, and the Board authorized an expenditure of $2,800.00 for the 1956 show.

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A report on awards for meritorious papers delivered and published in 1956 was presented by Mr. Schmid, who heads the Committee on Awards. All selections had not been made, but are to be ready for the directors within 30 days.

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Mr. Brown then read a report relating to our electric wire and cable members, with a recommendation that the Association organize a separate section for them and provide fuller programs of technical papers. The report, after considerable discussion, resulted in an action on the Board's part to set up an Insulated Wire Section of the Non-Ferrous Division, with authorization to hold a Spring meeting, if desired. **James E. Flood** was appointed by Mr. Whitney to serve as Chairman of the new section, a committee to serve which he will form. This section will provide a program for the production men of the insulating concerns in the wire industry and will be devoted exclusively to problems relating to the manufactures of electric wire and cable.

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After a recess for lunch, the meeting reconvened at 2:20 P.M.

★ ★ ★

Mr. Whitney brought up the matter of the discontinuance of stenotype transcripts of the discussions at technical sessions, which had been voted at the last Annual Meeting of Members. Upon reconsideration of the question, the Board voted to continue this service, but not to have them reported verbatim in the January issue, as has been the practice. Mr. Sickels was requested to use the stenotype reports as a basis for a running account of questions, comments and answers, without identifying the speakers. This arrangement was approved.

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As a final item of business, Mr. Whitney appointed the following men to serve as committee members for the coming year:

Nominating Committee for Directors: R. S. Worth (Chairman); and J. E. Flood, T. M. Girdler, Jr. and R. E. Brown (members).

Nominating Committee for Officers: S. Ray Snow (Chairman); and R. B. Roth, A. B. Dove and R. E. Brown (members).

Nominating Committee for Executive Committee: G. B. Wood, Jr. (Chairman); and F. M. Crapo, C. H. Williams, Jr. and R. E. Brown (members).

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Mr. Worth then moved that the directors approve and ratify the acts of the officers for the period covered by the Treasurer's report. Upon being seconded by Mr. Williams, the question was put by Mr. Whitney, resulting in unanimous approval.

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There being no further business before the body, the meeting was duly adjourned at 3 P.M.

Modern Rod Baker Trends

by Carl Mayer, Jr., President
The Carl Mayer Corporation
Cleveland, Ohio

Rod baker designs have come a long way since their inception. This article points out some of the features of modern rod bakers and the role they are playing in efficient production.

Producers of wire and wire products are riding the crest of a prosperity wave. Top management reports indicate that keeping up with the Joneses in the wire field today usually involves a switch to straight line production to provide a smooth, continuous flow of in-process work.

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The trend is graphically demonstrated by an upsurge in sales of high speed rod bakers designed to cut operating costs and save space. Sales of this equipment stepped up substantially in 1955 with manufacturers reporting as much as 1000% increases in the past year.

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While this increase is partially traceable to expansion in the steel industry, the opportunity to save dollars through modernization is a big factor.

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Our surveys of buying habits underscore the fact that plant size has very little to do with the decision to make production continuous. Basically, these firms are seeking to speed up baking of the lime coating, conserve space and generally do a better job of preparing coils and rods for cold drawing. High speed rod bakers also tend to reduce liability to hydrogen embrittlement in the wire and rods.

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Depending on production requirements, any number of high speed rod bakers can be installed in line with pickling baths. In many cases installation of "straight through" lines has resulted in systems which occupy considerably less floor space than was previously used. In these instances, double or multiple pin bakers are commonly used. This arrangement permits the processing of two or more yokes at a time. The effect is the same as though each yoke had its own single baker.

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For example, at one large wire mill, engineers report that installation of four rod bakers resulted in a 75% savings in floor space and reduction of baking time from a maximum of 6 hours to ten minutes.

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There is general agreement on the feasibility of effecting similar reductions in plants not so large. After installing high speed rod bakers, engineers in an Indiana wire company found it required only 350 cubic feet of 1000 BTU natural gas per ton of steel rod baked as compared to 840 cubic feet per ton required by other methods.

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Users have also found that time-consuming transfer of coils to out-of-the-way baking units is also eliminated in plants using the new high speed rod bakers for straight line cleaning. On these, cleaning and lime baking lines, coils and rods are loaded on yokes of 3,000 to 4,000 lbs. capacity by fork truck. The entire line is serviced by gantry or other type cranes that transfer the loaded yokes through various cleaning stages, starting with the pickling of the hot rolled concentration and rod

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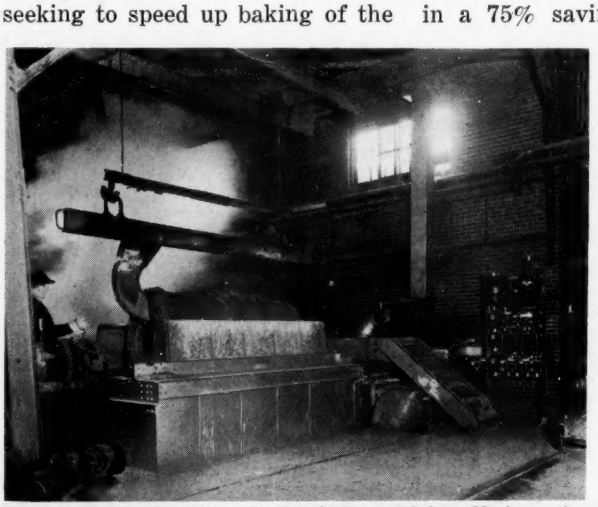

Figure 1—Rod bundles being placed in high speed baker. Maximum time required for baking—15 minutes.

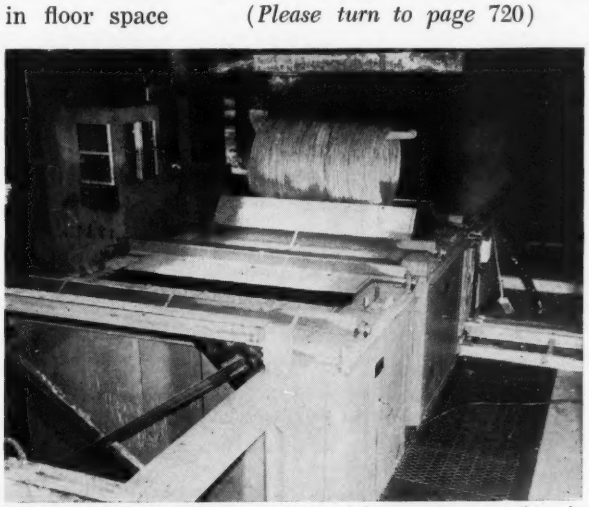

Figure 2—Baked rods being removed from baking oven, now ready to be drawn.

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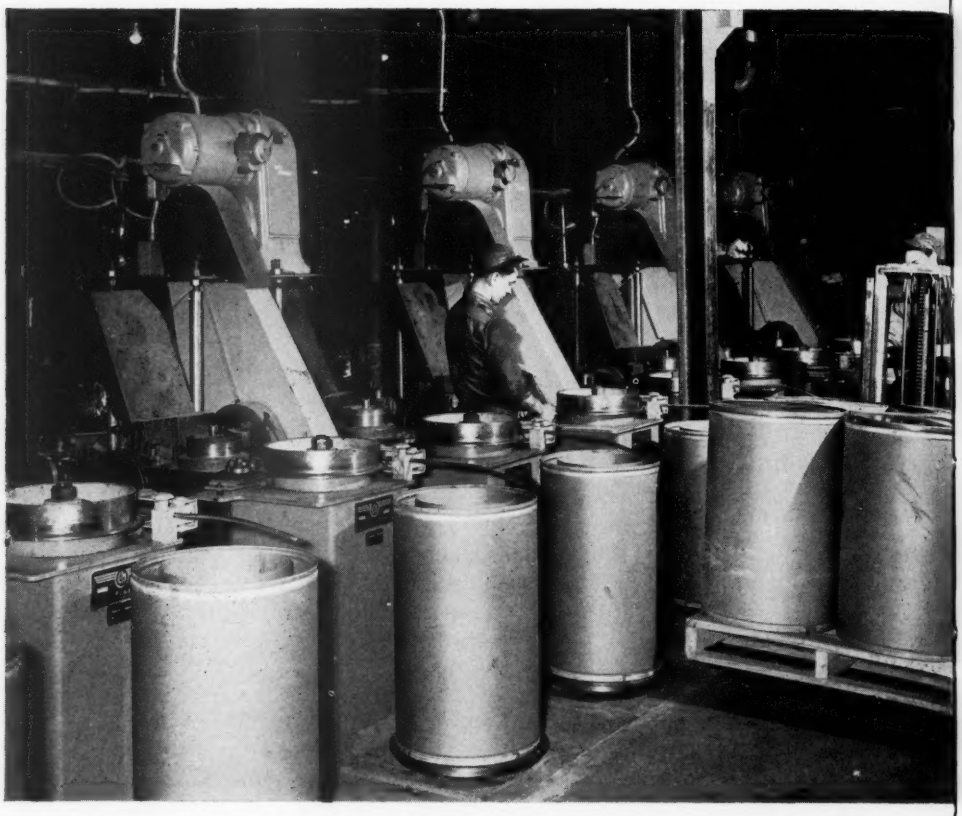

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Physical, Chemical and Electrical Properties Of Marlex* Ethylene Polymers

by Dr. R. Vernon Jones, Paul J. Boeke and Walter R. Clark
Phillips Chemical Company
Bartlesville, Oklahoma

A paper delivered at the Fourth Annual Wire and Cable Symposium of the Signal Corps at Asbury Park, N. J., on December 6, 1955. In it the authors give data on the properties of this new resin and discuss some of the factors affecting its applicability to the wire and cable industry.

Introduction

The adoption of the "child of war," polyethylene, by the Government for the wire and cable industry is well known. The characteristics of the polymer which worked for or against its use in this field have been discussed many times. (1). A striking development in the improvement of the basic nature of ethylene polymers has recently been made by **Phillips Petroleum Company.** This development is based upon the polymerization of ethylene at low pressure.

Physical Properties

The ethylene polymer selected for initial commercialization by Phillips Petroleum Company is designated as **Marlex** 50. However, the Phillips process can be made to produce thermoplastic resins which have properties that range from soft, flexible polymers to the tough, high modulus **Marlex** 50 resin.

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This paper presents data indicating many of the unique properties of **Marlex** 50 polymer in comparison with conventional polyethylene, and also contains a very brief discussion of some of the factors affecting its applicability to the wire and cable industry.

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First, it should be noted that basic differences exist between **Marlex** 50 ethylene polymer and the Ziegler type polymers, not only process-wise (2, 3) but more importantly, property-wise. This is best illustrated in figure I, which shows a polyethylene spectrum and certain of the physical properties of the ethylene polymers which vary with density and/or crystallinity. This spectrum clearly illustrates some of the differences between **Marlex** 50 and Ziegler polyethylenes and shows the relative position of these two materials as well as conventional polyethylene on the density scale. It shows the high modulus **Marlex** 50 resin at one end of the spectrum and the low modulus conventional polyethylene at the other; with Ziegler polymers occupying an intermediate position. Also indicated are ranges of properties of other **Marlex** experimental polymers. As such basic properties as crystallinity increase, so in turn do rigidity, softening temperature and tensile strength. Elongation and impact strength decrease, but it must be remembered that these two properties are also quite dependent upon molecular weight.

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Table I shows the excellent balance of properties of the **Marlex** polymers and indicates an obvious superiority over conventional polyethylene for many applications. As a result of its higher crystallinity, **Marlex** 50 polymer has a higher softening temperature, approximately double the tensile strength and much greater stiffness and abrasion resistance. For comparison purposes, the prop-

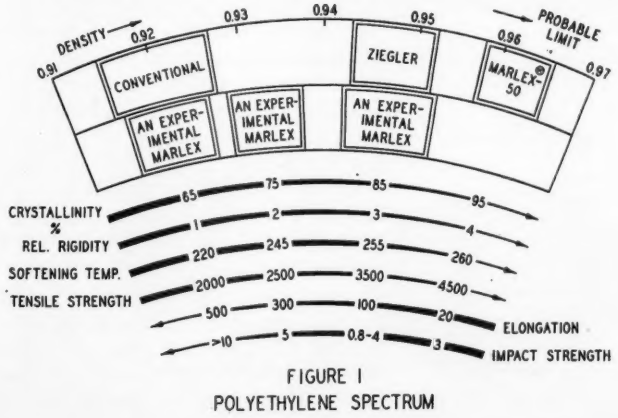

FIGURE I
POLYETHYLENE SPECTRUM

TABLE I

PROPERTIES OF VARIOUS ETHYLENE POLYMERS

Properties	High Press. Pk	Irradiated (10^7 rep.) High Press. Pk	MARLEX 50	Irradiated (10^7 rep.) MARLEX 50	MARLEX Copolymer
Melt Index	1.8	N.A.	0.6	N.A.	0.5
Density	0.92	0.92	0.96	0.96	0.92
Softening Temp. (°F.)	222	228	262	266	247
Brittleness Temp. (°F.)	-112	-	<-180	-	<-180
Tensile Strength (psi)	1900	2307	4200	4290	1600
Stiffness (psi)	25,000	-	140,000	150,000	50,000
Elongation (%)	600	500	28	22	370
Impact Strength (Izod)	>16	>13	3.0	2	9.5
Hardness (Shore D)	49-51	50-52	67-69	70-72	49-50
Abrasion (Taber Index)	17	-	5.7	-	22

* A trade-mark of Phillips Petroleum Company.

TABLE II

CHEMICAL RESISTANCE OF ETHYLENE POLYMERS

Chemical Environment	% Weight Increase on Immersion for 30 Days		Tensile Strength After 30 Days' Immersion	
	MARLEX 50	High Pressure Polyethylene	MARLEX 50	High Pressure Polyethylene
Control	-	-	4975	1745
Automotive Lube Oil	0.63	3.4	4848	1688
Mineral Oil Brake Fluid	0.19	0.82	4856	1780
Automotive Gasoline	6.0	12.9	4210	1430
Methyl Carbitol	0.13	0.31	4986	1750
Acetone	0.66	1.26	4416	1628
Oleic Acid	1.57	0.70	4774	1662
NH_4OH (28%)	0.013	<0.01	4688	1682
NaOH (50%)	<0.01	<0.01	4724	1672
HNO_3 (70%)	0.26	0.33	4896	1698
H_2SO_4 (98%)	0.1*	0.1*	4185	1516
Water	<0.01	<0.01	4844	1672

* Weight loss.

TABLE III

EFFECT OF 200 HOURS OF ACCELERATED WEATHERING[1] ON PHYSICAL PROPERTIES OF MARLEX 50 ETHYLENE POLYMER

	Tensile Strength (psi)			Elongation (%)		
	Control[2]	Masked[3]	Exposed[4]	Control	Masked	Exposed
MARLEX 50	5610	3670	1530	27	7	2
MARLEX 50 + 0.25% JZF	5230	5130	5250	30	37	40
MARLEX 50 + 2% Monarch 74	5880	5670	5890	25	27	25
MARLEX 50 + 0.07% JZF and 2% Monarch 74	5100	4920	5046	25	30	35
MARLEX 50 + 0.07% JZF and 2% Monarch 74	5100	4970	5100	25	40	40

1. Atlas Twin-Arc weatherometer with no water spray, air temperature 170° F.
2. Unweathered specimens.
3. Specimens protected from UV in weatherometer with aluminum foil.
4. Specimens subjected to both heat (170° F.) and UV in weatherometer.
5. Specimens exposed for 400 hours.

erties of irradiated conventional polyethylene and irradiated **Marlex** 50 resin, as well as one of the **Marlex** copolymers, are shown. High energy radiation does not impart the same degree of improvement to **Marlex** 50 polymer as it does to conventional polyethylene. With conventional polyethylene, irradiation increases tensile strength and imparts shape retention at 250° F. **Marlex** 50 polymer is not greatly affected by the same treatment and already has shape retention at 250° F. Most significant effect of irradiation on **Marlex** 50 resin is an increase in resistance to environmental stress cracking, as one sees in Table IV.

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Marlex 50 resin has an over-all toughness and abrasion resistance which, combined with its high tensile strength, light weight, heat resistance, and low temperature flexibility, enhances its utility in the wire and cable industry. This resin has been successfully coated on wire using conventional equipment and techniques with the exception that higher stock temperatures (roughly 75°F.) are required because of the higher softening temperature of **Marlex** 50 polymer. Wire coated in this manner gives coatings which adhere well to the conductor, are smooth, have void-free surfaces with excellent abrasion resistance and are serviceable at higher temperatures. The high modulus **Marlex** 50 insulation also gives good stability to the positioning of the conductor in the dielectric because of its rigidity and its reduced tendency to cold flow. Some experimental **Marlex** 50 coated wire has shown thermal cracking after several hours at 250° F. under a stressed condition. This difficulty has been overcome in the laboratory in three ways:

1. **By using the proper conditioning.**
2. **By compounding with other resins.**
3. **By using Marlex copolymers.**

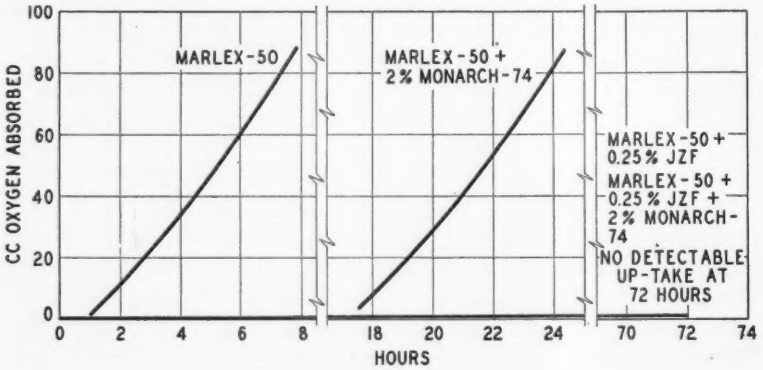

FIGURE 2

OXYGEN UP-TAKE CURVES FOR MARLEX-50 AT 150C

Chemical Properties

The extraordinary resistance to most corrosive chemicals and solvents at normal temperatures for polyethylene resins is well known. Infrared spectra indicate a linear structure for **Marlex** 50 resin with no detectable branching, and X-ray diffraction and nuclear resonance measurements reveal a crystallinity of from 90 to 95 per cent. Such factors are sufficient to account for the superior chemical resistance of this polymer over the high pressure variety. Table II shows a comparison of data obtained at room temperature; however, even at elevated temperatures only hydrocarbons and halogenated hydrocarbons act as solvents.

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All ethylene polymers are susceptible to oxidation at elevated temperatures and to photo-oxidation under normal conditions. These phenomena have been discussed extensively by MacLeod (4), Biggs (5, 6), Wallder (7), et al. Such reactions can be inhibited, and **Marlex** 50 resin responds to antioxidants and carbon black in a similar manner. Figure 2 illustrates the effectiveness of an antioxidant and carbon black in protecting this polymer against oxidation at elevated temperatures, and Table III shows the protection of

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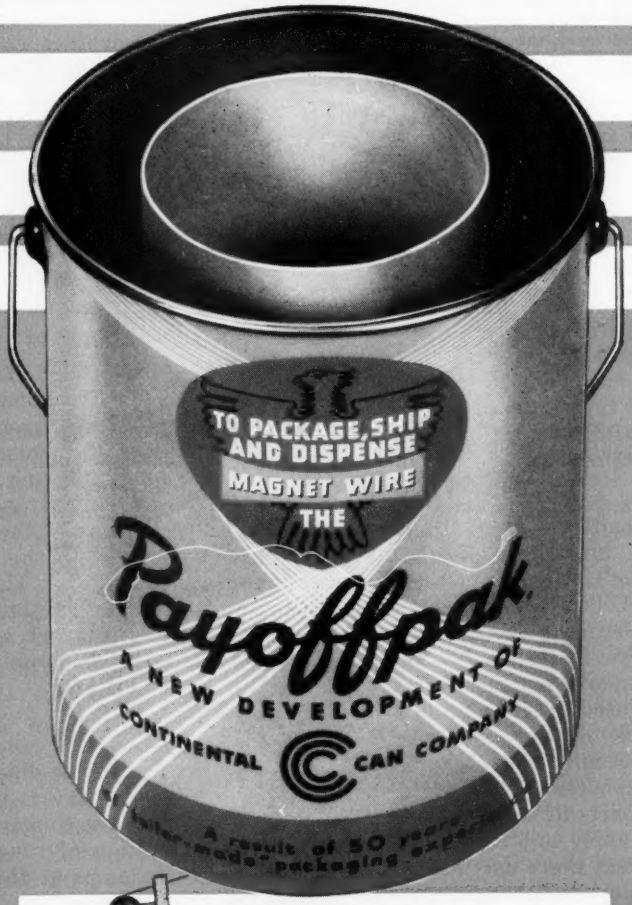

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Stainless Steel Wiredrawing Through Diamond Dies

by W. F. G. Kerley
Member, Technical Staff
Samuel Fox & Company, Ltd.
Sheffield, England

Mr. Kerley, as a guest speaker of the Staff School of Frederick Smith & Company, Ltd., delivered this lecture at one of its sessions. Prior to his association with Samuel Fox and Company, he was with the British Diamond Wire Die Company. Subsequently, for many years, he was engaged in the study and practice of fine stainless steel wire drawing, during which he developed an intimate knowledge of horology and precision production techniques. The paper is published here through the courtesy of Frederick Smith and Company.

Introduction

It is probably true to say that no other branch of fine wiredrawing is so beset by difficulties and problems as that of drawing austenitic stainless steel and nickel-chromium resistance wires through diamond dies.

★ ★ ★

Out of the difficulties inherent in stainless steel wiredrawing—not the least of which is the rapid deterioration of dies and machines—arise many problems which to the mill manager or foreman, preoccupied with the management of his department, are a source of harassment. But for the engineer, metallurgist, or other investigator who may be so placed as to be free from day to day production worries, these difficulties can provide a fruitful field for investigation, and it is the intention in this paper to adopt the role of a qualified investigator who has been assigned the task of assisting the foreman or departmental manager in the solution of his problems. To this end it is advisable first to trace the development of stainless steel drawing up to the present time, and later to consider some of the factors from which the difficulties arise.

Historical Background: Wire—Machines—Dies

Wire

The production of stainless steel wire through diamond dies is a comparatively new branch of the ancient craft of wiredrawing.

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The introduction of stainless steel in this country is dated at 1914, when Harry Brearley of Sheffield persuaded a business friend to produce stainless cutlery from his martensitic stainless steel. This type of stainless steel was successfully forged and hardened and tempered.

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The austenitic alloys of stainless steel were introduced into this country from Germany much later, during 1924, but were in fact patented in Germany as Krupp austenitic alloys in 1913. Historical notes on important inventions are often confused because of the simultaneous development which frequently occurs in wide and unconnected spheres of activity and in various parts of the world; this might well apply to stainless steel, in which event there may be found further and even earlier references to chromium steel and chromium nickel steels, both in America and Germany.

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All the technical data later appearing in this paper is concerned with austenitic steel of low carbon content such as the well-known 18/8 (18% chromium 8% nickel) alloy.

Machines

In the early days of fine stainless steel wiredrawing, the manufacturers of wiredrawing machines had, through gradual evolution, designed drawing machines capable of high speed production of copper, brass, and steel and mild steel wires. The development of fine stainless wire production should, then, have had a good start; and indeed it has been assumed that the continued trend towards the higher machine speeds would also serve to reduce production costs in the drawing of stainless steel wire.

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The fact is, that whilst modern high speed machines developed for fine stainless and nickel-chromium wire production are, in themselves, good examples of engineering skill, their development is in advance of our knowledge of many of the factors which contribute to the high wear rate of diamond dies. The resultant high cost of fine stainless wire thus limits a market which otherwise could be considerably expanded.

Dies

The development of the diamond wiredrawing die industry is popularly supposed to have commenced with the introduction of tungsten wires for electric lamps at the beginning of the century.

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It is probable that the first diamond die was a product of a watch factory in the French Jura. Ruby and sapphire jewel holes were made there, also sapphire dies for the wire which was subsequently rolled for the hairsprings of their watches; powerful trade guilds then existed for the protection of these crafts and exact historical facts are not available.

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During one of many visits to the

watch manufacturing areas of Switzerland and France, the writer saw, in an old established workshop near Besancon, a virtual grandfather of wiredrawing machines still in use; though functioning on the single hole principle, it is doubtful, having regard for the metallurgical requirements of the subsequently rolled hairspring wire, if any improvement could today be made. Here also were seen diamond die maintenance machines which were modified watch jewel-hole polishing machines.

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Before World War II large quantities of diamond dies were imported into this country from the continent of Europe. The Belgian and French dies usually demonstrated a high degree of skill and finish especially in the superfine sizes, however, although remarkably well finished, the dies were made from diamonds which were generally inferior to those used today by the British diamond die makers.

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Diamond die users will recall the earlier method of using a large diamond set in a silver solder mount. The diamond weight to diebore ratio was then very much greater than that in use today; however, the stone was frequently little better than bort — in fact large Congo stones of low quality were often used. Today very high grade diamonds of much smaller carat weight are used for wiredrawing dies. No longer is reliance placed upon stone size plus hard solder to resist premature failure, but very much smaller and higher grade diamonds are reinforced against that risk.

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Having briefly considered past developments it may be of advantage to review the set-up of a modern fine wire mill in order that some typical problems may be seen against the background of a particular set of circumstances.

A Modern Fine Wire Mill

The plant, housed under modern factory conditions, includes new fine wiredrawing machines of the type used in the steel wire trade. The continuous bright annealing furnaces are of the three zone type with six or twelve tubes, automatic temperature controls, and recording instruments. There is a reserve ammonia supply system together with an auxiliary cracker. The die maintenance shop is equipped with modern polishing machines, mostly of the wire type. The finished stock room, dispatch department and loading bay, are appropriately organized with automatic scales, calculating aids, and mechanical handling facilities. The general conditions appear to be ideal, especially as the raw material is supplied to the mill in the softened and descaled condition as required, in sizes around 18 gauge.

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Whilst the experience of past generations of wiredrawers has been incorporated in the design of the modern machines and equipment of this mill, we should be wrong in assuming that given ideal factory arrangements, modern drawing machines, supplies of good material and adequate die stocks, local unskilled labour could, without much difficulty, deliver the goods with the success that has been claimed for some branches of light engineering working on continuous automatic production.

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In looking back over the stepping stones of past progress, one recalls memories of the old line shafts and single hole drawing machines, where early wet drawing trials were made with stainless steel wire, and of the experimental machines constructed for multiple drawing of fine stainless wire through diamond dies; of the lubrication trials made before the refinements of circulating pumps and magnetic filters, and of the explosion of an early experimental bright annealing furnace. There were also the home-made scaife plates and diamond piercing machines, and the struggles to make the best of inferior stones.

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Difficulties which have actually been experienced in a modern wire mill such as described have served time and again to emphasize the need for fundamental knowledge since this must, in the case of green labour, replace something of what might otherwise be gained only by a tradition born of long experience.

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Here then is a great opportunity and a duty, to enhance the efficiency of the wire mill staff by passing on information and instruction gained in specialized fields of experience.

Specialized Training

Attention must first be directed towards the diamond die maintenance section, for it is there that improvement in efficiency and technique can make the greatest contribution to the economy of stainless wire drawing.

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True to the principle of mass production technique as previously outlined, the original instructions to the die repolishers probably amounted to little more than threading a wire through a die, fixing it into a rather indifferent type of self centering chuck, and letting it waggle away with a little diamond powder until enlarged to the next gauge size. The machine was intended to supply the necessary degree of skill as in a fully automatic process.

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The dangerous assumption that the diamond die stocks are simple units of production tools, well maintained because they have been correctly catalogued in shop records, must be speedily corrected; in order to achieve this it is necessary that an alternative working system be adopted. This alternative will not yield sudden spectacular gains, for it must be based on sound training and will therefore be a long term policy; for the purpose of developing the theme of this paper the obvious answer of importing trained or specialist labour has not been applied.

Diamonds

Although only the maintenance of diamond dies is undertaken in the die departments of most wire mills, it is necessary to review some of the basic factors of diamond die manufacture in order to provide the fundamental knowledge which must influence sound repolishing technique. In doing this it is advisable to remove all

thoughts of the encased dies with their uniformity of size and shape, and examine a parcel of natural diamonds (Fig. 1.) where each natural product has its own individuality. No two diamonds are alike, so that individual and specialized treatment has to be given at each stage of the die manufacturing process.

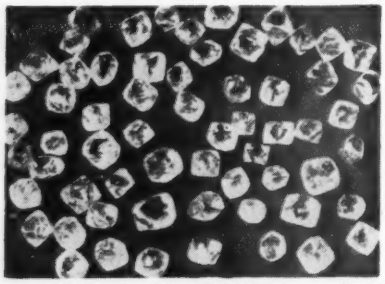

Figure 1—Wire Drawing Diamonds. * * *

Origin of Diamonds.

Diamonds are found in widely separated parts of the world, but roughly in an equatorial belt of latitude 10 degrees; North of the Equator, they come from Sierra-Leone, the Gold Coast, British Guiana, Venezuela and Borneo. Diamonds have also been found in the U. S. A. at Arkansas but, so far, only in very small quantities. India was famous as a diamond producing country some three hundred years ago, but the workings seem now to be exhausted. Some of the world's most valuable diamond fields are to be found south of the Equator—in Brazil, the Belgian Congo, Angola, South Africa, and a few in Australia. The most southernly and incidentally the richest diamond mines are at Kimberley almost 30 deg. South.

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There are two main types of diamonds—alluvial diamonds, i.e. found near or on the earth surface in the sand and gravel of dried up river beds; and mined diamonds, which are found several thousand feet below the surface. Brazilian diamonds are alluvial, so also are stones from Australia, the Congo and British Guiana. The deep mined diamonds come from around the Kimberley area where the most famous mines are still rich in diamonds.

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The original source of alluvial and mined diamonds is the same; early in the earth's history diamond was formed by natural forces—carbon, heat, pressure and time; this last quality is one which has defeated all attempts at synthetic production. Volcanic action has spewed up diamond-bearing matrix from unknown depths through rock fissures or 'pipes' as they are called. Some of these pipes are richer than others, whilst some pipes containing the characteristic blue ground associated with diamond-bearing matrix are not diamond bearing at all.

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Alluvial diamonds, recovered from surface gravels of dried up river beds, were probably moved great distances during the ice age and the breaking up of continents, where Australia, India and South America were formerly joined. This type of diamond shows surface indication of abrasion probably due to extensive movement over a considerable period of time.

Some Physical Properties of Diamonds

Diamonds show no evidence of being subjected to heat since their crystallisation, although they will show some change when heated to a temperature of 800 to 900 deg. centigrade in the presence of oxygen. Diamond will, in fact, burn readily when raised to white heat and produces carbon dioxide. Diamond can be converted to graphite between the poles of an electric arc. Graphite and diamond are different forms of the same element, diamond being the hardest substance known, whilst graphite is relatively soft.

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It is because of its hardness that diamond is so useful in industry, enabling work to be done which in many instances could not be performed in any other way. Diamond also has a remarkable optical property in its high refractive index of 2.45. This, of course, is the reason for the wonderful display of spectrum colours when cut as a brilliant; this ability to bend light rays more than other materials should be borne in mind when viewing highly polished die contours.

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Some diamond cutters claim that stones vary in hardness according to the different mines from which they are taken and there is no doubt that there are characteristics with natural diamonds which are common to one particular mine or source. It is claimed that by examination of a sufficiently large parcel of stones, an experienced diamond merchant could name the source of the diamonds.

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As will be explained later, there is a definite, although not always well defined, grain in diamonds; there are also sometimes knots in this grain. Therefore, it is more difficult to polish some diamonds, particularly in certain directions. The hardness, however, must not be confused with toughness or resistance to polishing, drilling or sawing.

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Diamond occurs in many colours, from the almost colourless to pale yellow and also with brown and green tints. Colour is associated with impurities, so that die stones are usually selected from whole natural diamonds in the clear white to clear yellow class.

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It can be added that the specific gravity of diamond is 3.53, and that diamond is a good conductor of heat—the conductivity being half that of aluminium. Diamond, when pure, is a non-conductor of electricity, and its estimated thermal expansion is about one-twelfth that of steel.

Crystallography of Diamond

Diamond crystallises in the cubic system, and for the purpose of this paper each diamond will be considered in its ideal form as an octahedron (i.e. as two pyramids secured base to base)—a figure having eight triangular faces, six points, 12 edges and three axes. From this shape it is easy to describe the primary cleavage planes which are parallel to the octahedron faces. If such a shaped natural crystal were cleaved on the eight faces, eight triangular plates of

diamond would be obtained. (See Fig. 2.)

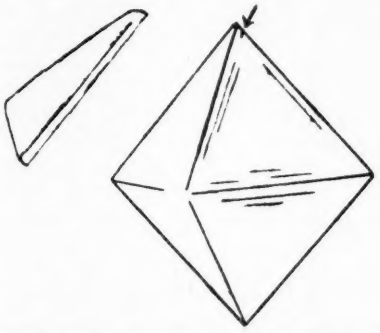

Figure 2—Primary Cleavage Plans—Octahedron.

Alluvial diamonds show a general rounding of each crystal so that the octahedral form is not easily discernible, also the striation, so pronounced at the edges of most regular crystals, is less distinct. At this stage it would be advisable to consider all other shapes to be octahedrons in disguise, sometimes as a dodecahedron, and sometimes with two enlarged octahedron faces. The diamond cutter has to see through this disguise in order to cleave the stones as required, polish according to the grain indication, and orientate the crystal so that the working portion or wear resisting zone is at its optimum value. (See Fig. 3 (a), (b), (c).)

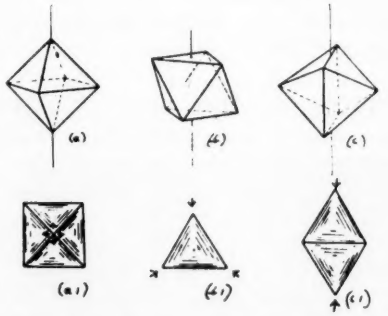

Figure 3—(a) (b) (c) Orientations of Die and Crystal Axis. (a 1) (b 1) (c 1) Grain indication of Polishing Direction.

The diamond is easily cut or polished on a scaife plate when the direction of attack is at right-angles to the grain, but although the crystal shape, cleavage and grain indications enable rapid cutting directions to be applied, one has to consider the ultimate orientation of the die drawing angle to the cleavage planes when polishing the die base facet.

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Irregular crystals and twinned stones are difficult to polish in certain orientations. The point of a true octahedron offers considerable resistance to polishing; this is the reason why the natural octahedron points are used as emery wheel dressers. The two point direction offers little polishing resistance, and diamond die manufacturers frequently select dodecahedron crystals, thus enabling quick polishing in the two point direction of both flats and windows. Of 50 British made diamond dies recently examined by X-ray methods, the majority had the drawing axis near the two point direction, many were 3 point, but only one was anywhere near the four point direction which has been claimed as the ideal direction to give maximum die life.

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It can be seen from Fig. 3 that if the die-bore axis followed the line in (a) then the four cleavage planes would be equally inclined to the die axis at a larger angle than attainable by (b) or (c). It is quite well known that diamond die makers do not often use this orientation, for in the first place it is very difficult to polish a flat on a true four point. The conjunction of the four natural octahedron faces make it impossible to orientate the crystal in a favourable position on the polishing lap (scaife plate). The alternative is to apply a "bruting" method, i.e. to rub another diamond against this point until a flat is created, and then finish on the scaife plate with a small inclination from perpendicular. Although the bruting method is applied to diamond cutting for gem stones, it is not sound practice to use this method on a diamond die which has to withstand a high working stress during wiredrawing.

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The use of a scaife plate with a small inclination of the diamond axis from the perpendicular in the finishing of the flats also has a disadvantage in that by this method absolute symmetry in orientation is lost. In any case, as the usual die stones do not closely conform to the pattern here used for crystallographic instruction, it is extremely difficult to attain an absolute fourfold axes of symmetry by the normal diamond die manufacturing techniques.

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The X-ray pattern shown in Fig. 4 shows the only fourfold axis found in the 50 diamond dies, and this is several degrees from a true position.

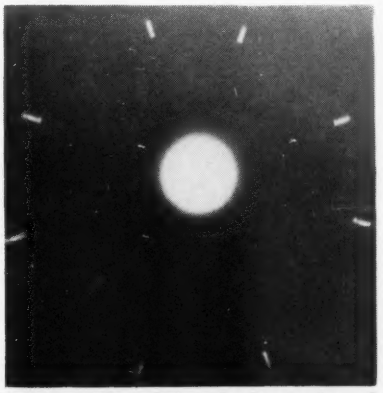

Figure 4—X-Ray photograph (Laue) along the 4 point direction.

Many of the dies examined were drilled as in Fig. 3 (b)—the three point direction. Such diamonds were usually distorted octahedrons with two enlarged faces which were used for the base and top flats of the die. These flats were frequently n a t u r a l unpolished faces. The die axis was therefore perpendicular to an octahedron face as shown in Fig. 3 (b). The disadvantage of this orientation can readily be seen, but the exact location of the wire impingement point on the crystal must be known before its parallelism to planes of cleavage weakness can be determined. Some die makers use this orientation simply because unless every stone is specially selected for their dies (this increases the price of course) there is a natural tendency to use all they can of each parcel of diamonds. In this case some natural flats may be large enough without further polishing work. The true three point polishing direction of a natural octahedron face as indicated by the striation marking in Fig. 3 (b. 1.) is not readily polished on a scaife plate; fortunately these faces are seldom perfectly equilateral triangles, and one of the three cutting directions will prove favourable — if not, a slight inclination will be necessary.

The X-ray pattern shown in Fig. 5 indicates the three-fold axis, the double pattern on the print is due to the stone being a twin crystal. This die actually came recently from Holland, and although the use of macles for steel wiredrawing is not considered sound practice (macles are always 3 point), this die gave a satisfactory wire yield.

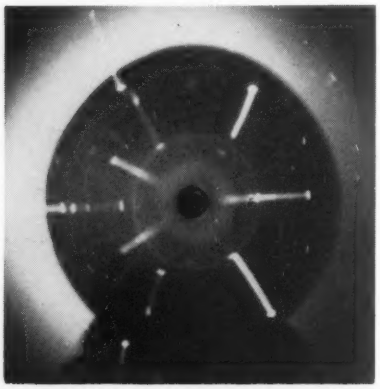

Figure 5—X-Ray photograph (Laue/oscillation) along the 3 point direction (twin crystal). * *

The majority of the dies examined were in the Fig. 3 (c) group, here the line indicating the die axis gives two cleavage planes parallel to the die bore, and two planes at 55 degrees. The high grade selected die stones are mostly of this order, for the die makers can readily polish flats and windows in the two point directions indicated by Fig. 3 (c. 1.).

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The X-ray pattern shown in Fig. 6 is a two point with interference caused by the broken stone.

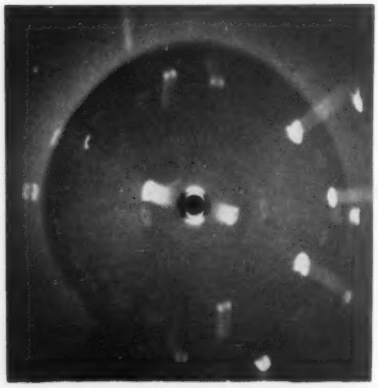

Figure 6—X-Ray photograph (Laue/oscillation) along 2 point direction (broken crystal). * *

All the X-ray films were taken on completely cased dies at the end of their useful life. Each new die is now carefully checked on receipt from the makers, so that the crystal to die axis orientation reference is included with the diamond die life chart. By this last named measure it is hoped to prove the accuracy or otherwise of the claim made by the writer in a paper to the Industrial Diamond Association of America, wherein he wrote of "having formed the opinion that the orientation of the die bore to crystal axis is not a factor of major importance to die life when diamonds are subject to the usual conditions of reinforced mounting," etc.

Diamond Die Mounting.

There are several points worthy of note here, for the subject has a direct bearing on the foregoing matter; now that it has been shown that there is quite a lot of detail to study inside a diamond die case, it may be assumed that the trainee staff will no longer visualize these dies vaguely as a brass or steel disc with a hole through it.

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Although the principle of casting a hard reinforcing metal around a die stone is particularly useful to the steel wire-drawing trade, the method originated on the Continent in the manufacture of copper drawing dies. These dies contained very small diamonds, but they were guaranteed for a certain tonnage of copper wire.

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The usual method of reinforcing diamond dies is to deposit a silicon cast iron material around the stone after it has been drilled and semi-finished. This method has several disadvantages, the principal one being the high melting temperature of the reinforcing media which is above 1100 deg. C. When this metal is deposited with an oxy-acetylene flame there is a risk of burning the diamond.

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A mild steel case of approximately half inch diameter is sometimes used, and the silicon cast iron is deposited whilst the diamond die is held in a central position by a carbon rod. During the heating cycle, this small case, which is also near the melting point, sometimes allows the diamond to settle a little, and this frequently causes the die axis to become slightly eccentric to the case. If the die be left only .0002" undersize for finishing, it is possible to complete the polishing without either increasing or correcting this error, the die will be used satisfactorily at its initial size, but at the first repolishing the maintenance man may create ovality, unless he first examines it on a wax plate. Many such dies are placed in the self centering cup of wire type polishing machines and are made oval in the first repolishing; this is not a fault of the machines but of the die maintenance man. One method previously used to overcome this fault was to stand the diamond on a tungsten carbide disc while the mounting media was deposited on and around it in the usual manner.

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A better method is to encase the diamond before drilling it, in this way the risk of superficial burning of the die bore is obviated; also, less of the natural crystal boundary need be cut away in the flattening, and no window is required. By this method the die-bore axis to the die case is maintained with absolute precision during manufacture; the absence of an inspection window is not a great handicap, as this is required only on dies below .006" dia. and in that size range, dies are not reinforced.

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All discarded diamond dies should be removed from their cases, examined, and studied in relation to the life records; this will be good practice for the maintenance personnel, and it will become quite obvious to them that no matter what orientation of the diamond is used for drawing dies, the final failure is always lateral from the point of the wire impingement ring in reinforced diamond dies.

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With hard soldered and low melting point mounting media, failure may be found, as expected, along the cleavage planes. The ideal type of mounting material is one that will give the reinforcing qualities of cast iron shrunk around the stone, yet at the same

time avoiding the high temperature necessary for its deposition.

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Whilst diamond is the hardest substance known to man, a stone may easily be cleaved into two pieces with a relatively light blow. Although the diamond may be reinforced against premature bursting by properly applied loads, the nature of this mounting material does, of course, convey shock to the diamond. For this reason it is dangerous to stamp serial numbers on the die case, or subject it to shock in any other way. Fortunately, most die manufactures cover the reinforced slug with a brass case, which in addition to conducting heat, does assist in the prevention of accidental damage by shock.

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A type of diamond which resists shock, and which is sometimes made into drawing dies, is the Carbon or Carbonados from Brazil. These diamonds are not single large crystals, but are crystalline like the diamond bort from which diamond powder is made. Carbons are polycrystalline, and therefore have no planes of cleavage weakness. The black coke-like appearance of carbonados and the fact that it is not possible to impart in them a high polish, detracts from their use for wiredrawing dies, although their toughness is favoured by mining technicians for boring crowns. The X-ray print of a carbon die in Fig. 7 is typical of a polycrystalline substance; no cleavage is possible.

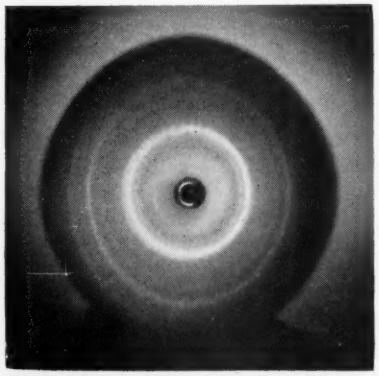

Figure 7—X-Ray photograph of carbonado diamond (polychrystalline).

Diamond Powder and Bort

The introduction of hard metals —tungsten carbide, etc.—has resulted in a large demand for diamond powder to grind and polish these metals into various forms. The Dutch name for diamond fragments — boort — has remained to cover the impure and crystalline type of diamond which is obtained in larger proportions than other diamonds from the Belgian Congo.

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The production of diamond powder has improved in quality during the past ten years, and it is now possible to purchase very finely divided size ranges of powder. For instance, a size range of 40 to 100 millionths of an inch (1 to 2½ microns) can be obtained. These very narrow ranges are suitable for use by skilled personnel as they enable the user to work in the upper limit of his permissible range.

Diamond Die Repolishing

This subject cannot be more than briefly mentioned here, but it has been indicated quite plainly in the earlier paragraphs that individual and specialized treatment must be given to each diamond die. Our objective is to create this form of approach in the trainee labour.

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Needle or broach type die polishing machines are to be preferred because each die for repolishing may be accurately centred on a small wax face plate and optically checked for concentricity.

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Wire type polishing machines should be used only for close finishing with 0 to 3 micron diamond powder. The maximum powder size for this type of machine should be fixed at 6 micron, and the total removal should not exceed .0003 inches.

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A small bruting lathe should be set up for the recutting by hand of all badly ringed dies. A few years' training on this simple machine would provide a good background training for a youth later to become a die-man.

Stainless Wire Drawing

The starting sizes for diamond drawing stainless steel and nickel-chromium resistance wires are usually within the range .040″ to .028″ diameter. Finishing sizes may be anything from .036″ to .001″ diameter, and sizes even finer than .001″ are sometimes required for electrical resistance wire.

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For drawing 14 or 15 gauge stock down to the required starting size it is quite usual to apply a lead coat and then multiple draw to 18 or 19 gauge, after which the wire is deleaded, and bright annealed through a continuous furnace.

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The chart Fig. 8 shows a multiple drawing sequence of nine diamond dies, giving a total area reduction of 88%, from .036″ to .0124″.

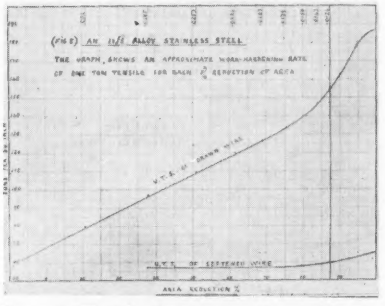

Figure 8—Work-hardening rate of an 18/8 wire.

The drawing machine used was a multiple 9-die machine with a finishing speed of 600 ft. per minute; the drafting was such as to create a fairly high percentage of drawing cone slip, and the dies were located in reciprocating die holders. The wire and dies were fully submerged in a lubricant reservoir of light mineral oil.

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Upon investigation it was found that the wear rate on the drawing dies was in the reverse order of the footage or milage of wire delivered by the whole set, i.e. the wear rate was greatest at the largest die and decreased slightly at each die towards the finishing end.

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It is common knowledge that the first diamond die in a sequence as described will have a high wear rate; there are several reasons for

this—the wire is not prestressed by passing under die tension round a drawing cone, and this also enables the wire to whip in the die entrance; the fully softened stock has a matt surface which produces increased friction in the die; and after even the best bright annealing the wire may have an indiscernible oxide film which would have a very adverse effect on die life.

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Fig. 9 shows a typical microphotograph of fully softened wire in the condition as supplied to the first die; Fig. 10 shows the same wire after reduction. The action of drawing the random orientation of metal crystals in Fig. 9 through the first diamond die, has an effect which is not dissimilar to the action of the scaife plate on the die flats, except that the die bore cannot be favourably orientated as with scaife polishing. In fact, if a flat were to be incorrectly orientated on the scaife plate to produce "greying," then there would exist to a minor degree at least one of the adverse conditions present in parts of the die bore whilst drawing.

Figure 9—Microphotograph of fully softened 18/8 wire showing nicely equiaxed grain. Mag. 200.

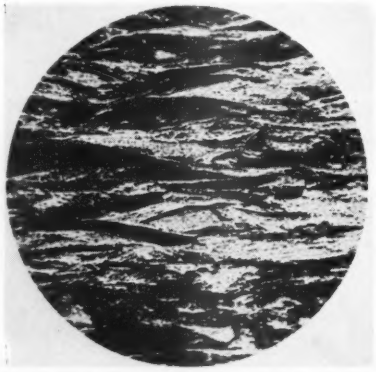

Figure 10—Microphotograph of wire in Figure 9 showing heavily elongated grain after drawing.

As drawing proceeds the crystaline structure of wire becomes fully orientated in the direction of applied stress, and the wear rate diminishes; this despite the fact that the wire is hardening rapidly and is taking on a lustre which is difficult to wet with lubricant.

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Fig. 11 shows the actual measured pounds pull for each die included in the chart and the wire breaking load at each size. A study of these figures reveals that the ratio of die to wire load is approximately the same at each stage (allowing for drafting variation and variable die polishing). The mathematician would state that the zone of die/wire contact per unit area would also give a progression of the same order. From a practical viewpoint the wire technician may be inclined to disagree with this and state that whereas the die pull at .0285" is 50 lbs. the resistance of the diamond to failure through cleavage planes is of the same value at .0124". In other words, there is an increasing safety margin of die pull to diamond resistance through the draft towards the finishing end.

Fig. 11

Die Dia.	Lbs Pull on Die	Wire Breaking Load
.032	55 lbs.	141 lbs.
.0285	50 "	136 "
.0253	45 "	124 "
.0224	49 "	106
.0203	29 "	91 "
.0179	28 "	74 "
.0158	29 "	61 "
.0143	18 "	52 "
.0124	23 "	42 "
.0113	12½ lbs.	37 lbs.
.010	15 "	31 "
.0092	9 "	27 "

Figure 11—Diamond die loads for graph 8.

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There are then two hypothetical points to explain this wear rate: (I) the friction caused by crystal flow in the direction of applied stress in the first stages, and (II) as friction decreases with drawing, so does the margin of safety against premature failure increase with the use of progressively smaller die bores.

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A further thought on die wear is that extremely high local temperatures may be reached in the die drawing zone, which might result in graphitised particles of diamond being torn away. X-ray studies of worn dies have not, however, revealed graphite lines.

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No exact scientific explanation of what really happens when a diamond is polished on a scaife plate has yet been satisfactorily propounded. It has been claimed that in an experiment a rapid cutting direction, applied to a diamond on a scaife plate situated inside a specially constructed chamber, was arrested when a vacuum was created inside the chamber; thus supporting a theory that the diamond is burned, which in the case of wiredrawing die wear, would indicate a change of minute diamond particles to CO_2, and the passing of the CO_2 into the drawing solution. In this connection reference must again be made to the danger of superficial burning of the die stone when the silicon cast iron is deposited by oxy-acetylene flame. With the aid of a fine oxy-acetylene burner fed with excessive oxygen the writer has made holes through diamonds in a matter of seconds, for experimental purposes.

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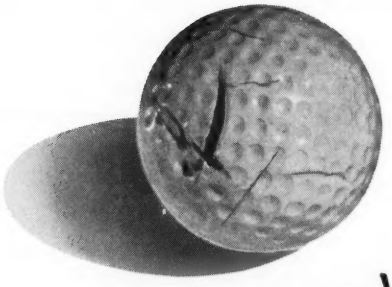
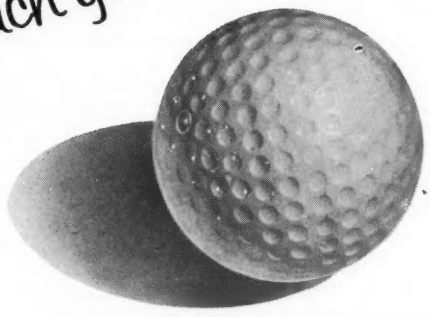
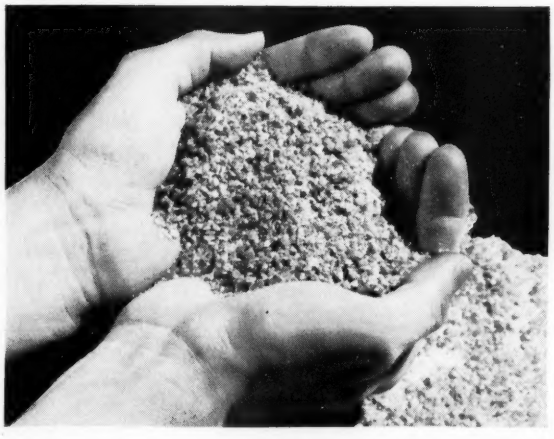


If you were a golf pro, which golf ball would you use?





You'd use the new one of course. You couldn't afford to risk your winnings on the erratic flight of an old ball—just for a small savings.

It's the same with diamond abrasives. You can't afford to risk your profit on the performance of reclaimed diamond. It's too big a gamble for a small economy. Play to win with dependable diamond—virgin diamond. **ALL ELGIN DIAMOND is virgin diamond . . . say ELGIN and be sure!**

An $8,000 handful of pure, virgin diamond bort ready for crushing and grading to produce ELGIN Diamond.

ABRASIVES DIVISION
Department G

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS

The Past 125 Years

by Harry G. Stoddard
Chairman of the Board
Wyman-Gordon Company
Worcester, Massachusetts

This talk was delivered by Mr. Stoddard on April 25, 1956, at the annual dinner of the Worcester Chamber of Commerce and the Worcester Engineering Society commemorating the founding of the steel and wire industry of America and, more specifically, honoring the American Steel and Wire Division of the United States Steel Corporation on the occasion of the 125th Anniversary of its beginnings in Worcester.

Worcester is famous for many men, founders of industries that have become great. Tonight's gathering is primarily to honor the beginning of wire making in Worcester 125 years ago. **Ichabod Washburn,** the pioneer, is noted not only for his industrial success but for his character and his great civic contributions.

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In 1814, at the age of 16, Ichabod was an apprentice blacksmith in Leicester.

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At 18 years of age he entered into a two-year contract which provided $50.00 a year, board and clothes, and 12 weeks of schooling.

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At 20 he became a journeyman blacksmith and later operated a small business of his own in Millbury, the product being ramrods. This was thanks to a loan without security from **Daniel Waldo,** of the famous Worcester family. During Ichabod Washburn's life he was interested over the years with a number of different people in a variety of enterprises, the first being **Washburn & Goddard.**

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Looking over the early records, one is impressed with the fact that nothing is stationary where ambition exists and that various products and organizations followed each other in rapid succession. During all this early period, however, Ichabod Washburn had his eye always toward the wire development and those processes contributing to it. One by one other products were dropped and often continued by his one-time partners.

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This is not the place to attempt a detailed historical record of the years leading up to the establishment of **American Steel & Wire** and the **U. S. Steel Corporation.** I will, however, spot a few highlights based on dates which will give something of the picture of the activities of Ichabod Washburn during those years and the men who were associated with him.

1819—Ramrods, hand forged—Millbury.

1822—Machinery, lead pipe—School St., Worcester, 20 employees.

1831—Wire and screws—in a wooden building at Northville.

1835—Wire—in a brick building erected on Grove St., by Stephen Salisbury and leased to the Washburn Company.

★ ★ ★

The water power came from the erection of a dam, which resulted in Salisbury Pond. The rental was listed as $1011.00 per year. There is in existence an original autographed statement by Ichabod Washburn that as the result of six months work, ending April 1, 1835, the receipts were $9558.23 with a profit of $2000.00.

★ ★ ★

I think I should pause here to refer to the great contribution to Worcester's growth by **Stephen Salisbury** and **William Merrifield,** who built during 1834 to 1844 seven factory buildings and rented them with power to small industries.

1840—Development of water power and plant at South Worcester, later the Worcester Wire Company.

1847—Telegraph wire.

1849—Quinsigamond Wire & Iron Works. Wire rod development.

1850—Music wire. Philip L. Moen, son-in-law, became a partner of Ichabod Washburn.

1852—William E. Rice, who later became President of Washburn & Moen Company, entered the employment of the company as a clerk at a salary of $50.00 a month.

★ ★ ★

These last two men, during their lives, contributed immensely to the success of the industry in Worcester. Mr. Rice later left the company and developed organizations of his own and at the last round-up he was back with Washburn & Moen Company and his independent companies had been consolidated with Washburn & Moen Company, all entering the American Steel & Wire at the same time in 1899.

1856—First continuous tempering in Ichabod Washburn's back yard on Summer St.

1857—There is in existence a statement signed by William E. Rice showing operation of the company for the year ending June 30, 1847. The total value of the year's output was $194,800.00.

1859—Shows employment at Grove St. plant of 120 people and a production of 3 tons of wire a day.

1863—Cotton mill to furnish covering for crinoline wire which was approximately 4 tons a day.

1868—Philip L. Moen became president at the death of Ichabod Washburn.

1869—The first rolling mill at Grove St. Initiated by Mr. Washburn.

1873—Bessemer steel appeared, stimulating greatly the uses of wire.

1875—700 employees. Barbed wire.

1880—2100 employees.

1884—Copper wire.

1889—Wire rope. The growth of the company is emphasized by fact of 3000 employees.

1890—Insulated wire.

1891—Springs. Mr. Rice became president on the death of Mr. Philip L. Moen.

1899—At this time Washburn & Moen Mfg. Co. had become the largest and most varied producers of wire products in the U. S., and was acquired by the American Steel & Wire Co. At that time William E. Rice was President; Charles F. Washburn, Vice President; Philip W. Moen (son of Philip L. Moen), General Manager; Charles G. Washburn, Counsellor; F. H. Daniels, Chief Engineer.

1901—U. S. Steel Corporation formed.

It has been well said that history is largely biography. Certainly this applies to Ichabod Washburn. His contributions to Worcester were innumerable. He founded Memorial Hospital in memory of his two daughters, gave the Washburn shops to the Tech, established the Home for Aged Women, was a large contributor to the building of Mechanics Hall one hundred years ago, and gave most generous support to the churches. An unusual and interesting gift was that of a substantial sum to a small college in Topeka, Kansas, which was likely to fold up. As the result the name was changed to Washburn College, now a substantial institution and the students call themselves "Ichs."

★ ★ ★

He thus left an example which has been followed by many. Among these are those trained in their parent industry who have organized companies of their own and also by many founders of other industries and those who have succeeded them. Worcester is favorably known the nation over for men of these characteristics.

★ ★ ★

Just to list a few of the names that indicate in a remarkable way our indebtedness to the founders of many of our industries and to the later generations who are carrying them on certainly rings a bell: **Washburn, Morgan, Daniels, Logan, Swift, Brigham, Crompton, Knowles, Hutchins, Gage, Norton, Johnson, Higgins, Goddard, Jeppson, Barton, Rice, Wyman, Gordon-Fuller, Heald, Whittall, Leland, Gifford, Wright, Boynton, Salisbury, Rockwood, Curtis, Marble, Reed, Merrifield, Graton, Knight, Edwards, George, and Thompson.**

★ ★ ★

The name Thompson, listed, has special significance for me. It refers to **George Thompson,** President of the **Thompson Wire Company.** He and I were associated together in those early days of the Washburn & Moen Company, and our friendship and acquaintance has continued to this day.

★ ★ ★

In the program I notice I am listed as a "commentator." When given this honor I was told that it was because I had begun my working life as a teenager with Washburn & Moen. Largely through great good fortune I held various positions which brought me in contact with some outstanding people and gave me opportunity to observe many others. To carry out the order assigned me tonight, with due apology, I will mention some personal experiences.

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I was hired as a teen-age boy for my first job with Washburn & Moen by Charles F. Washburn. Busy as he was he had a policy of hiring the new boys. My conversation with him was most interesting. I had learned that he usually started boys at $6.00 a week. I had a paper route which earned me considerably more than that. So, as I used to tell Reginald Washburn, his son, the old gentleman made the mistake of asking me what I expected. I told him $12.00 a week. He said $9.00 was all he could pay. So my nerve brought me something. Three months after being employed a period of depression came and everybody was cut 10% which made my wages $8.10. This indicates some difference between that day and this.

★ ★ ★

The employees had a chance to observe a good many things that were happening, particularly because of the telegraph instrument installed in the office. The barbed wire business was very important and was supposedly controlled by patents. **John W. Gates,** later to be prominent in the Steel Industry, with some associates, was thought to be trying to get around the Washburn & Moen patents. The story was he had some barbed wire machines on a barge which moved from one side of the Mississippi River to the other when some one was trying to find out what they were doing. The company sent **John Curtis,** then superintendent of the South Works, to St. Louis to find out what he could. One day a telegram came which read, "We have just kicked your Mr. Curtis out of the back door."

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In the early days of my employment, **Fred Daniels,** father of Harold, was chief engineer and admired by all. I owed him much.

★ ★ ★

It is interesting to note how much we emphasize "firsts" in our lives. This incident may be of interest to some younger salesmen in the audience. As a result of illness of the regular representative, my first trip as a young salesman was to the **Stanley Electrical Manufacturing Company** in Pittsfield, Mass., now a branch of the General Electric. The inquiry from them was for some cotton covered magnet wire. I remember the purchasing agent very well, Mr. Whittlesey, father of the famed commander of the "Lost Battalion." I introduced myself, quoted him the price and kept quiet. He began to ask me detailed questions regarding the cotton, the method of production of the copper. I extemporized a little. I saw I was getting in deep water so I said, "This is my first trip out. I cannot answer your questions in detail. I simply don't know. I do know our company makes the best magnet wire. I will go back to the plant, get the answers to your questions and come again." I can see him now as he said, "Son, you have learned one important thing; namely, to say 'I don't know'. The order is yours."

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A somewhat similar recollection, later in life, when a young man called upon me to interest me in material for windows that would let in light, was unbreakable and fireproof. He had a sample and I took it without any thought of what would happen. I lighted a match and it burned like a torch. He looked at me and said, "They told me it wouldn't burn," and left.

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Perhaps in these brief incidents there are lessons for all of us.

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As an assistant in the office of Philip W. Moen, I had an opportunity to see what was going on. There were many interesting visitors. **Charles N. Schwab,** before the formation of the Steel Corporation, used to visit Mr. Moen to

(*Please turn to page* 713)

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Developments In Submarine Communication Cables

by J. J. Gilbert
Ocean Cable Engineer
Simplex Wire and Cable Company
Newington, New Hampshire

The author delivered this paper at the Signal Corps Fourth Annual Wire and Cable Symposium at Asbury Park, N. J., on December 8, 1955.

The submarine cable is now over 100 years old, and judging from recent news items regarding new installations, it is still going strong. Its early years were attended by tribulations, the accounts of which make interesting reading today for the general public and arouse admiration on the part of present-day cable engineers for the courage and ability shown by the early workers in the field. It was undoubtedly due to the principles established by these early workers that the submarine cable art is still active. The basic principle, sometimes termed "proven integrity", is the refusal to accept any proposed modification in structure or material of the cables as permanent until it has been put through the ordeal of being placed on the ocean bottom, and has survived for an adequate time—20 years in the opinion of a distinguished British cable engineer. The minimum requirement in any new development in submarine cables, more than in most other fields, is to profit to the full from the fund of experience.

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To guard against changes creeping in accidently, the utmost care has been used in cable manufacture. This has resulted in a high degree of assurance of quality of product. There are still in operation today sections of cable as old as 75 years. The conservative traditions of the art acted as a block to progress in improving the cable itself. It did not discourage efforts in making the most efficient use of what the cable could deliver in the way of traffic. There was continuous improvement in the terminal equipment, involving among other things ingenious mechanical gadgets to amplify and shape the signals and to reduce the effect of static noise.

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When the time came to apply vacuum tube circuits to submarine terminal equipment, it was found to be a difficult matter to replace these mechanical appliances by electrical circuits. For many years the cable itself did not change essentially in structure. The structure of a representative telegraph cable is shown in Figure I. It was coaxial in nature, consisting of a central copper conductor, stranded in order to insure electrical continuity. The strand could take the usual form of a number of wires laid helically on a central one, or "surround" tapes could be used in place of the outer wires so as to make the conductor truly cylindrical. This conductor was then insulated with gutta percha, and in order to protect this so-called core against the hard usages that the cable undergoes in laying and repair operations, outer layers of jute and armor wire were provided. The electrical circuit of the cable consisted of the central copper conductor with the armor wires and surrounding sea water as a ground return.

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At the turn of the century the telegraph cable occupied an exalted position in the communication world. There was nothing to compete with it for rapid transoceanic service. About that time long wave radio started making rapid strides, however, and by the end of World War I it appeared necessary, in order to make the lay-

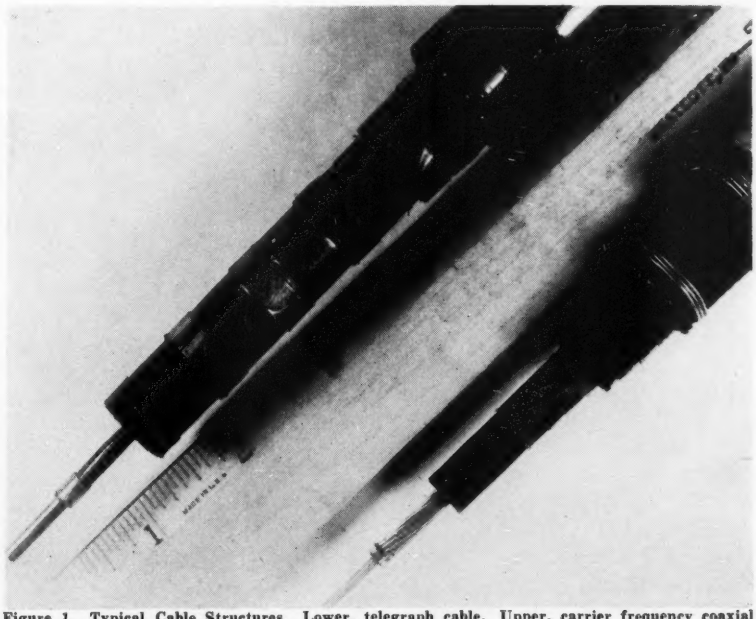

Figure 1. Typical Cable Structures. Lower, telegraph cable. Upper, carrier frequency coaxial cable.

ing of new cables attractive, to modify their structure so as to obtain greater message capacity. The permalloy continuously loaded telegraph cable, the first example of which was laid in 1924 between New York and the Azores, provided the answer to this need. The loaded cable could have a message capacity at least five times that of a non-loaded cable of the same length and dimensions. The loading operation consisted in winding a thin tape of nickel-iron alloy on the central copper conductor of the cable, then heating the whole to a high temperature to bring out the magnetic characteristics, then as part of the insulating procedure, surrounding the strain sensitive permalloy with a viscous material to protect it against irregular transmission of hydrostatic pressure at the ocean bottom through the gutta percha insulation.

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Before accepting a new structure such as this, it is necessary to establish that it will not be damaged by the ordeal of passing from the ship's tanks to the ocean bottom. Representative cable laying machinery is shown in Figure II. The cable first passes, in several turns, around a drum attached to a brake which restrains the cable from running out under the laying tension. This tension, amounting in some cases to several thousand pounds, is due to the weight of the cable suspended between the ship and the ocean bottom. The cable then passes over the three sheaves of a dynamometer, then over a sheave at the bow or stern of the ship, thence into the water. Due to its comparatively slow rate of sinking, the cable may, in deep water, trail the ship by as much as ten miles before touching bottom. In this suspended length each bit of cable is subjected to a complex cycle of tensions and torsions, the latter being due to the fact that the strength members, the steel armor wires, are laid on the cable helically and tend to unlay under tension. The resulting untwist may affect the electrical characteristics of the insulated conductor. Laboratory tests can be devised for putting short lengths of cable through a simulated laying cycle, but the final answer can only be obtained by laying a length of 20 miles or so in deep water. This is the old principle of proven integrity coming to the fore. In the case of the permalloy loaded cable, the test cable, 120 miles in length, gave satisfactory results and within a few years many thousands of miles of such cable had been laid. These cables offered good competition to the long wave radio from standpoints of cost and reliability.

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It is of interest to note that this was the first use of permalloy for electrical purposes. As soon as the material was brought out of the laboratory and into the factory, other uses were found for it, notably in the low frequency transformers and the high speed relays which were needed for the terminal equipment of the loaded telegraph cables. Vacuum tube amplifiers and new principles in printing telegraph equipment were employed at the terminals in order to make full use of the wider frequency band. This introduction of new materials and methods to the electrical industry in general has been repeated many times in the history of the submarine cable development, the reason being that the extreme refinement in methods and the elimination of undesirable characteristics in material, even at considerable cost, has been a must in the cable art. Later the advantage of these improvements, especially in the communication line, have been recognized.

Figure 2. Cable Laying Machinery.

★ ★ ★

A good example of this was furnished by the developments immediately following the loaded telegraph cable. It was desired to explore the possibilities of transoceanic cable telephony. With the materials and structures immediately available, realization of this goal was quite out of the question. The Key West-Havana telephone cables laid in 1921 and continuously loaded with iron wire represented about the best that could be accomplished, and with cables of this design, a distance of not much more than a few hundred miles could have been traversed without repeaters. Going to as large and heavy a cable as could be safely laid did not provide the answer. For one thing, the dielectric constant of gutta percha was too high to permit of obtaining the low capacitance that was required. The power factor of gutta percha was also too high in view of the fact that the telephone cable required inductive loading. Greater stability of electrical characteristics over a period of years was also necessary. A fundamental study, therefore, had to be made of the factors influencing dielectric characteristics. As a result a new material, paragutta, was developed. Its stability was assured by removing as far as possible all water soluble materials and adding antioxidants. Iron and permalloy were both unsatisfactory for long range tele-

phonic communication over cables, and a new material, perminvar, was developed. This material had about the right balance between permeability and resistivity, and was also characterized by constancy of permeability over the range of signaling currents in the cable. These developments presented a notable example of an ideal—that of having design engineers specify their requirements on as yet unknown materials.

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Improvements in the design of the cable structure were also required. Except for its much greater size, the insulated conductor or core of the telephone cable resembled the core of the permalloy loaded cable. It was found that for telephone frequencies, the resistance of the ground return path is higher than desirable, due to a skin effect phenomenon which forces the return current to flow more and more in the high resistance armor wires as the frequency is increased. In place of using the armor wires and sea water as the ground return a copper conductor was provided, consisting of 6 tapes laid helically on the insulation and closely conforming to the surface of the latter. The structure of this type of cable is shown in Figure I. The copper return conductor was first used in the 1921 Key West-Havana cables. For the new cable, the design of this structure was improved so as to get as low effective resistance as possible at the higher frequencies of transmission.

★ ★ ★

This intensive work on the development of new insulating and loading materials and on new structures led, in 1929, to a design of cable, which proved, by test in deep water, to be capable of furnishing a single voice circuit across the Atlantic. The depression, however, removed the need of additional transatlantic telephone circuits, and short wave radio, which was coming into its own about that time as a very satisfactory means for transatlantic telephony, cast a very dark shadow on the future of the submarine cable.

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The submarine cable fortunately had a very vigorous and successful ally, wire communication on land, and a study of the progress in this latter field guided the submarine cable engineers to what they considered a very happy conclusion. The transmission problem is roughly the same for submarine cables and land lines; that is, with a given structure and length of line, and with a given power at the transmitting end, it is found that beyond a certain frequency of transmission, the signals will be distorted by static or other noise. The amount of this distortion that can be tolerated will depend upon the quality of service that is to be provided.

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The submarine cable has an advantage over wire lines on land in being at comparatively constant temperature, so that the transmission characteristics are not subject to variations, and also in the fact that due to the shielding action of sea water, the static noise picked up by the cable falls off rapidly as the frequency is increased. In fact, at a frequency of several thousand cycles, it is found that the noise on the cable arising from noises above the surface of the ocean is swamped out by noise originating in the cable itself. The latter is the so-called thermal noise.

★ ★ ★

There are places where the submarine cable suffers a handicap compared with land lines. One is the lack of quick accessibility, especially in deep water. Another is that water pressure has a way of seeking out incipient weaknesses in structures subjected to it, so that every inch of a cable has to be perfect in order that the cable as a whole shall give satisfactory service over a period of years. The matter of joints in the insulation is a good case in point. After they are made in the factory, insulation joints are tested under water at a voltage higher than the cable is expected to be subjected to. Naturally, any joint that does not test good would be cut out and remade. In spite of this, it used to be an accepted fact that the safe operating voltage of a cable was far below the value that would be set by considering only the dielectric strength of the insulation, indicating a suspicion that the joints were not quite perfect. In recent years this condition has been remedied, but highly developed techniques and continuous vigilance in manufacture are required. Another place where the submarine cable is at a disadvantage compared with the land line is in the fact that during the laying operations there are stresses in the cable, both tensions and torsions, which if not properly taken care of in the design could cause irreparable damage to the cable circuit.

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Assuming that proper attention is being paid to these weaknesses of the submarine cable compared with land lines, improvement in transmission characteristics of the cable can usually be made by suitable adaptation of the methods that have been found successful in land line transmission. This was the case with inductive loading. Coil loading of submarine cables was considered undesirable because the frequent lumps in the cable might interfere with the smooth laying process, especially in deep water. Recourse was therefore had to inductive loading of the continuous type. After a period of successful use on land lines, the effect of inductive loading in limiting the band width was realized, especially as the art of carrier frequency operation developed. It was found desirable on some land routes to omit load coils in order to employ carrier frequencies, and this trend was followed in 1930 in the laying of a non-loaded cable between Key West and Havana. This cable had the general structure of the projected transatlantic cable of that period, without the magnetic loading material. It was ultimately equipped to provide seven voice circuits, whereas in the 1921 loaded cables each cable provided only one voice circuit, with some telegraph. Cables similar to the 1930 cable were laid in considerable number in European waters, in Australia and in Japan.

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The next development in land

(*Please turn to page* 705)

The World Market in Wire

In Germany, the majority of all city governments have now specified the use of 100-ampere cable for house construction in accordance with the recommendation of the National Association of Home Builders, which will make possible greater extension of electrical apparatus, air conditioning, etc. And as one consequence the demand for 100-ampere conductor wire is increasing.

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In the last quarter of 1955 Austrian industry was in the lead in deliveries of wire to Israel, and it seems likely that further orders are going predominantly to Austria.

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The Spanish Five-year Plan for dwelling-house construction to provide low-cost housing for three million people will influence imports, since the national production of steel, wire nails, screws, etc. will, in spite of increasing output, not satisfy the demand. The importation of investment goods will be curtailed, and accordingly more rolling-mill products and construction materials produced by the iron and steel industry will be imported.

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Receipt of orders for wire products during recent months has in most countries been smaller than production. However, since the orders for the Fall of 1955 had been very high, this will not initially affect the selling market, unless the situation changes this Spring.

★ ★ ★

In the U.S.A. the orders at the beginning of February represented a recession of two weeks relative to the condition in October, 1955; in Canada about one week, in England about one week, in Belgium/Luxemburg about three, in Italy and France about ten days, in Austria about one week, in Holland about two, in the Scandanavian countries and Switzerland ten to twelve days.

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Plastic wire is now being used in the U.S.A., Argentine and Uraguay for packaging and binding, yet it is not believed that this use will expand rapidly. The packing trades are buying plastic wire in different colors.

★ ★ ★

The English domestic wire rod price of £33.8.9 for wire with 0.08 to 0.25% C. and £36.0 for that with 0.42 to 0.60% C. has remained unchanged for some time. In wire circles it is considered, however, that the British industry will advance their quotations shortly by about a pound per ton, especially as these prices are considerably lower than the continental, and the wire working industry is in need of it.

★ ★ ★

The German wire industry protested strongly against the lowering of duties by about 50% for about 60% on all wire goods, because as a result foreign wire will find greater admission to West Germany, while the exports, which reached only 14% of the 1955 pro-

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duction, as against 30 to 40% before the war, must diminish still further.

★ ★ ★

In numerous letters overseas wire nail factories complain continually that the quality of nail wire turns out to be extraordinarily variable, not only as between the wire from different countries, but even from one and the same country, so that the production suffers in consequence. Often the wire is too hard, then again too soft, while there are also variations in dimension in spite of exact specifications. Not all wire nail factories are so large as to make the drawing of their own wire from rod profitable. A clear definition of nail wire with respect to its analysis and specific properties, valid internationally, is now lacking. It is understood that the High Court of Luxemburg has made a proposal to establish standard specifications for nail wire for export, which the British industry should also undertake, yet Luxemburg, cannot do it alone. The industries of the different countries rather must agree upon Standard Specifications.

Three Day Program in Worcester in Observance of A. S. & W.'s 125th Birthday

The highlight of the three-day program staged by the **Worcester Chamber of Commerce** and the **Worcester Engineering Society** was a banquet attended by approximately 1200 persons on April 25th at which the small beginnings and its development into the far-flung empire of the **American Steel and Wire Division of the United States Steel Corporation** was memorialized.

★ ★ ★

The principal speaker of the evening was **Clifford F. Hood,** President of the Corporation, whose subject was "On Ideas and Idealism." In his talk he spoke of many of the wire pioneers who had started in modest jobs and risen to positions of influence. Nowhere in the world, except America, he said, could these sagas of individual achievement have been duplicated.

★ ★ ★

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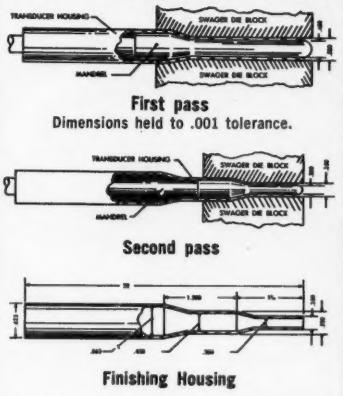
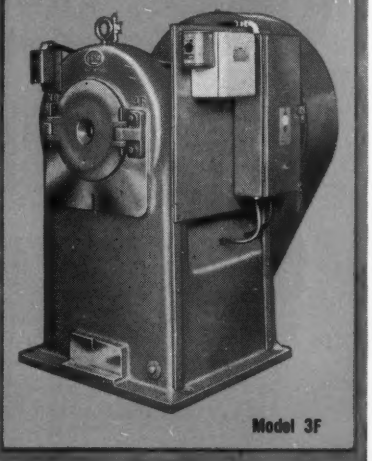


First pass
Dimensions held to .001 tolerance.

Second pass

Finishing Housing



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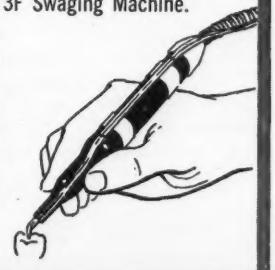

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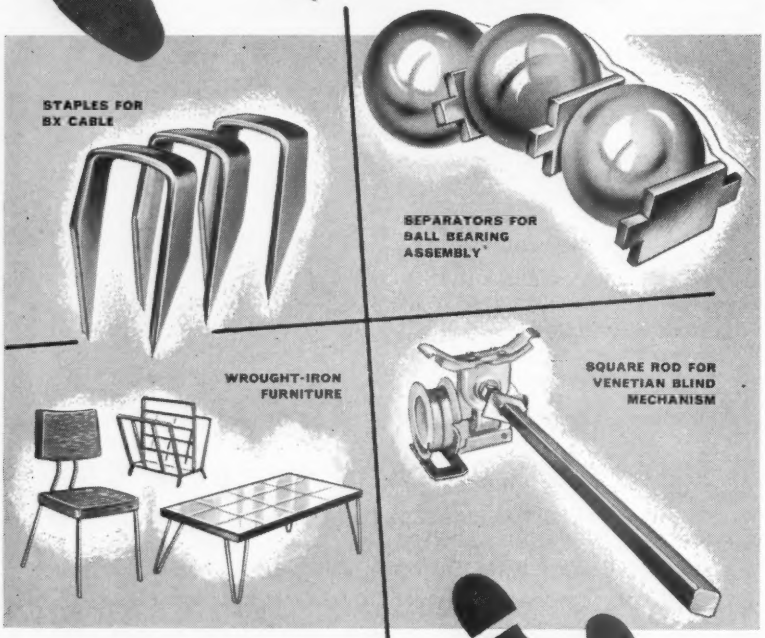
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Henry G. Stoddard, Chairman of the Board of the **Wyman-Gordon Company,** spoke on "The Past 125 Years." His talk was most interesting in that it was liberally interspersed with anecdotes regarding himself and others in the early days of building the wire business into a great industrial enterprise. He was one of the stalwarts who helped shape the destinies of the wire company.

★ ★ ★

Another feature of the program was the presentation to **John H. Hitchcock,** Director of Research and Chief Mechanical Engineer, **Morgan Construction Company,** of a Scientific Achievement Award by the **Worcester Engineering Society.** The presentation speech was made by **Norman A. Wilson,** Chairman, Award Committee, and the certificate was handed to him by **Robert E. Pfeif,** President of the Society.

Steel Capacity to Increase Throughout World

By 1960 the world's capacity for steelmaking will be increased by 87 million tons to 297,140,000 net tons a year—an increase of 29%.

★ ★ ★

The largest increase will be in Russia, which is aiming at a 25,-430,000 ton increment. Present capacity there is rated at 49,700,-000 tons. The Red bloc in Europe is expected to expand by 33,900,000 tons to a total capacity of 102,790,-000 tons—up 49.3%.

★ ★ ★

The U. S. expansion in this period is to add 17 million tons to give us a total capacity of 145 millions in the next 4 years.

★ ★ ★

New steel projects are planned also for Canada, Mexico, Peru, Venezuela, Brazil, Chile, India, China and Egypt that will add 23% to present capacity.

★ ★ ★

India produced 1,990,000 tons of steel in 1955 and hopes to have a capacity of 6,800,000 tons by 1960.

★ ★ ★

The following table compares production for 1955 with the planned capacity for 1960 of some of the leading countries:

	1955 Production	1960 Capacity
United States	117,000,000	145,000,000
Russia	49,700,000	75,130,000
Germany	23,470,000	26,800,000
United Kingdom	22,166,000	24,650,000
France and Saar	17,298,000	23,100,000
China	3,300,000	6,500,000
Canada	4,440,000	5,800,000

Insulated Wire Section of The Wire Association to be Formed

At the semi-annual meeting of the Board of Directors of **The Wire Association** in New York on April 20, 1956, a decision of far-reaching importance to the production men of electric wire and cable manufacturing plants was made.

★ ★ ★

This action of the Board authorized the organization of an Insulated Wire Section of the Non-Ferrous Division to give these operating men an opportunity to set up their own regional meetings and to arrange for complete technical sessions devoted solely to their problems at the Association's Annual Conventions.

★ ★ ★

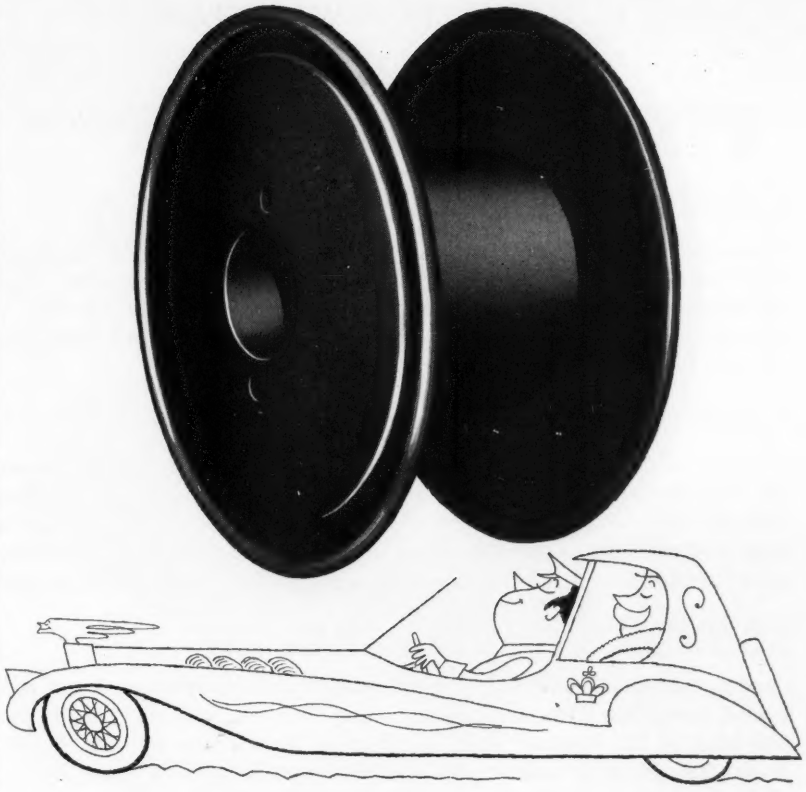
Various engineering societies are concerned with standards, research and other matters and this move is now made in response to many requests for a place where production men could assemble to hear papers particularly designed to meet their special interests.

★ ★ ★

James E. Flood, Chief Chemist, **The Plastic Wire and Cable Corporation,** Jewett City, Conn., was appointed Chairman of the new section by the Association's president, **Leslie C. Whitney.** Mr. Flood will organize a committee to work on meetings, papers, etc., and will invite all production men to attend and participate in them.

1955 Book of Standards Published by ASTM

The American Society for Testing Materials has completed and



Custom Built for Finer Service...

Apco Mossberg steel reels, spools, and bobbins are true works of custom engineering and manufacture . . . they are furnished to fit the exacting requirements of each individual customer.

Whatever the sizes or shapes you need in reels, spools, or bobbins, Apco Mossberg will furnish them manufactured to extremely close tolerances of balance and trueness.

Take advantage of our half-century of experience serving the needs of wire and wire rope manufacturers. Tell us about your reel, spool, or bobbin problems . . . our engineering and service departments will make suggestions and offer solutions without obligation. Write us or call collect . . . Attleboro 1-0340.

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San Francisco 11, Calif.

Canadian Representative:
HUGH P. WILLIAMS & CO.
47 Colburne Street, West
Toronto, Ontario, Canada

(The original Frank Mossberg Co.)

APCO MOSSBERG COMPANY
ATTLEBORO, MASS.

EFFICIENT, MODERN SYSTEMS

FOR

ELECTRICAL WIRE & CABLE MANUFACTURING

• *CABLE LACQUERING SYSTEMS*

Conventional cellulosic, or other type, lacquers are applied in successive continuous coats from one to twenty-eight coats over fibrous braid wrapped primary conductors. One end, four ends, or eight ends of wire are handled continuously. System includes letoff, application, drying and constant tension takeup equipment.

• *WIRE ENAMELING SYSTEMS*

Natural and synthetic enamels, silicones, solution nylon, modified plastisol, and similar insulating coatings are applied to bare, cotton or glass covered wire in round, square or rectangular cross section. Ten or twenty simultaneous strands are handled. Systems are complete with letoff, preannealer, application system, capstan and multiple takeup unit.

• *ASBESTOS INSULATING SYSTEMS*

Carded asbestos is applied to continuous single conductor as an integrated operation with saturating, rotary forming, drying, cooling and polishing of the finished wire. Wire from No. 20 gauge to No. 6 AWG is handled through an asbestos wall thickness range of from .008″ to .040″ thickness in a single pass.

• *RUBBER OR PLASTIC JACKETING SYSTEMS*

Rubber and thermoplastic jacketing compounds are continuously applied to electrical wire or cable by the extrusion method. High speed, constant tension letoff and takeup equipment, controlled cooling or continuous vulcanizing equipment are powered by synchronized range drives as complete, integrated wire handling systems. Extrusion machines of customer's choice are furnished.

• *GLASS & VARNISH COATING SYSTEMS*

Double layer of glass or cotton wrapping is applied to round, flat or square conductor. Two individual coatings of high temperature varnish are applied and the finish baked in a continuous operation. Units are complete from letoffs to takeup frames.

• *SELF TRAVERSING REEL CORD DRYERS*

These ingenious machines are used to remove hygroscopic moisture from fibers, braided or knitted flexible cable. These machines increase extrusion speeds, reduce blister scrap loss and improve diameter control. They are easily installed in existing extrusion line.

TECHNICAL INFORMATION ON ANY OF THESE PROCESSES UPON REQUEST

C. A. LITZLER CO., INC.

11621 DETROIT AVENUE

CLEVELAND 2, OHIO

published its largest triennial Book of ASTM Standards. The 1955 edition has over 11,000 pages and includes more than 2,150 standard specifications, tests, and definitions for materials. This important technical book is an excellent example of the valuable results which come from the intensive work of the Society's many members and active technical committees. ASTM standards are used not only by American industry and on the North American continent, but by many industries and governments throughout the world. The Book is issued in seven Parts, each pertaining to a particular area or group of areas of materials. It is published on bible-type paper with cloth covers.

★ ★ ★

The parts of interest to our industry are as follows:

Part I, Ferrous Metals; 315 Standards; price—$13.50.

Part II. Non-Ferrous Metals; 270 Standards; price—$11.00.

Part VI, Electrical Insulation, Electronic Materials, Plastics and Rubber; 300 Standards; price—$13.00.

★ ★ ★

Parts of the 1955 Book of ASTM Standards may be purchased (the complete set is priced at $84.00) from American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

New Seattle Plant for E. H. Edwards Co.

Completion of a new warehouse and office building in Seattle, Washington, has been announced by the **E. H. Edwards Co.**, manufacturers of wire, wire rope, and wire products for Western industry.

★ ★ ★

The new building, covering 13,300 sq. ft., approximately doubles the company's former office and storage space, according to **Ralph Brown**, Seattle District Manager for Edwards. Specifically designed to meet the needs of the Edwards operation, the building includes special loading docks and ramps to accommodate truck and rail handling of the heavy reels of wire rope used by loggers and contractors in the Seattle region. Modern materials handling equipment has

also been installed, along with a sprinkler-protection system.

★ ★ ★

The new Edwards building is located at 804 West Oregon Street in the new industrial section of Seattle. All equipment, personnel, and inventories from the former location of the E. H. Edwards Co. in Seattle have been transferred to the new building, according to the announcement. The company's main plant and offices are in South San Francisco, Cal., with branches in Portland, Los Angeles, and Houston.

Pin Pointing Service

Robert A. Main & Sons, Inc., 301 Pascack Rd., Paramus, N. J., offers a unique service in the pointing of pins and other wire products.

★ ★ ★

Besides manufacturing pointed products of many types, the company is geared to perform pin pointing operations to special order. All metals can be thus treated, as, for instance, carbon steel, stainless, brass, Monel, etc. wires, for fan head pins, nail head pins, long or short taper pins, folded pins, perforating pins and pinned bars, cylinders and shells.

★ ★ ★

The Company will be pleased to make quotations on any type of pointed products.

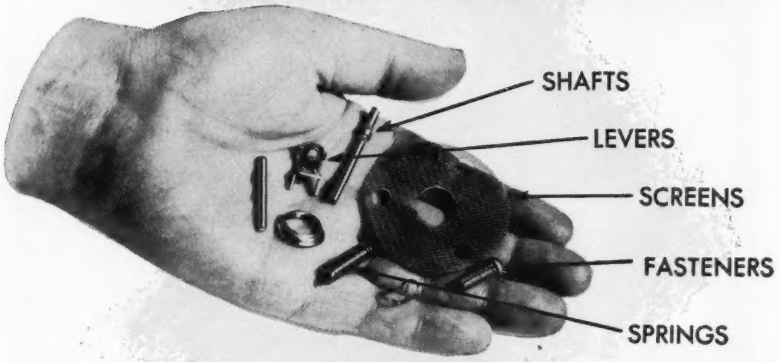
Scovill to Cast Aluminum Bar

William M. Goss, President of **Scovill Manufacturing Company,** Waterbury, Conn., announces that Scovill has acquired a license from **Continuous Metalcast Co., Inc.,** of New York, to practice the inventions of **Alfred H. Tessmann** in the casting of aluminum and aluminum alloys. The practice called "Vacuum Horizontal Continuous Casting" has been in commercial use for about a year at **Southern Electrical Corp.,** Chattanooga, Tenn., in the production of aluminum wire.

★ ★ ★

Development work is being intensified by Scovill so that this process may be readied for full scale production of slabs and bars

ARE *small* PARTS CAUSING YOUR PRODUCT FAILURES?



It Will Pay You To Use ALLOYS

How many times can you trace your product failure to the corrosion, wear or breakage of some small part? A screw . . . a shaft . . . small spring . . . a gear or other seemingly insignificant part? In most cases the failure can be blamed on the material from which the part was made. The use of Nickel Alloys or Stainless Steel Wire, Rod or Strip for these parts could have saved many dollars in service and replacement costs because of their superior engineering properties.

How much more will alloy materials cost? Actually, on small parts, fabrication, finishing and other manufacturing costs will more than likely far overshadow material cost. You will find that the extra cost of using alloys will be insignificant compared with the benefits in longer service life, lower maintenance costs and fewer customer complaints.

For informative technical data on our alloys . . . and for some good ideas . . .

SEND TODAY FOR OUR NICKEL ALLOY AND STAINLESS STEEL DESIGN HANDBOOKS.

ALLOY METAL WIRE DIVISION

HKP H. K. PORTER COMPANY, INC.
Prospect Park, Pennsylvania

KEYSTONE SPRING WIRE

Shaffer Sash Spring Co.
Des Plaines, Illinois

reports . . .

Long life—satisfied customers . . . and 50% lower production costs! These are the gains Shaffer Sash Spring Co. reports, using Keystone Spring Wire. Each year they supply millions of balance springs used in the manufacture of spring loaded window sash. Keystone Wire is standard for good reasons. Most important, Shaffer keeps their customers satisfied by producing a precision, high quality spring. There have been no fatigue failures since the first shipments of springs made of Keystone Wire. Perfect forming characteristics of Keystone Wire have enabled them to increase production and lower costs by 50%. That's because of Keystone's unique method of cold drawing *after* galvanizing. Coating is dense and smooth. Forming is consistent—free from flaking.

SEE YOUR KEYSTONE WIRE SPECIALIST

Keystone does not make springs . . . but does supply many leading companies with quality Spring Wire for better springs, lower production costs . . . and satisfied customers. High carbon and manganese steel spring wire—hard drawn, spheroidized annealed and music wires—are available in Keystone quality to match your spring needs. Also wire for Cold Heading and other industrial uses. Your inquiries are invited!

KEYSTONE STEEL & WIRE COMPANY, Peoria 7, Illinois

KEYSTONE WIRE *for Industry*

as soon as possible. Scovill during the past two decades pioneered the development of large-scale commercial continuous casting of brass billets and bars.

★ ★ ★

As stated by Mr. Goss—"The inventions of Mr. Tessmann appear to be an advance in the process of continuous casting which we have followed in the brass field since 1938, and are particularly applicable to the continuous casting of aluminum. Vacuum horizontal continuous casting represents another step toward ultimate perfection of basic casting process from which sheets, rod, wire and tube depend for their inherent quality. Metal fabricators should realize even greater soundness and uniformity in mill products from vacuum cast billets and bars than have been attained previously."

New Technical Bulletin Available from Alloy Metal Wire

Alloy Metal Wire Division, H. K. Porter Company, Inc. announces the availability of its new technical bulletin, T-3, which presents engineering and application information on nickel-clad copper wire. Also included in the bulletin are data on the electrical characteristics of the material. Nickel-clad copper wire is a composite metal, with a center core of oxygen-free, high conductivity copper and a sheath of "A" nickel. It combines the good electrical and heat conductivity of copper with the outstanding heat and corrosion resistance of nickel.

★ ★ ★

Widely used in the aircraft and electronic industries, nickel-clad copper offers the design engineer interesting properties that can be used to advantage in many industrial products.

★ ★ ★

For a copy of technical bulletin T-3, write to Alloy Metal Wire Division, H. K. Porter Company, Inc., Prospect Park, Pa.

Why don't you join
THE WIRE ASSOCIATION?
Send for booklet and a
membership application card.

Outstanding Personalities of the Wire Industry

Robert M. Harbeck Joins Wire and Wire Products

The publishers of **Wire and Wire Products** take great pleasure in announcing that **Robert M. Harbeck** became a member of its staff on May 1, 1956, in the Advertising Department.

★ ★ ★

Mr. Harbeck graduated from the Massachusetts Institute of Technology in 1928 with a degree of B. S. in Civil Engineering. He has worked in an engineering capacity with a number of concerns and served as a manufacturer's representative for the **Boyd & Sons Manufacturing Company,** manufacturers of wire spooling machines, and **The Edmands Company,** producers of wire twisting equipment.

★ ★ ★

He joined the **Fidelity Machine Company** of Philadelphia in 1944, where he worked as a Field Engineer, selling knitting and related equipment up into late 1955, when he resigned to start his own business.

Robert M. Harbeck

Bob Harbeck is favorably and widely known throughout a large segment of the wire industry. He has been a member of **The Wire Association** for twelve years and presented a technical paper on knitting equipment at the Annual Convention in Pittsburgh in 1944.

★ ★ ★

He is married and has two children.

Three ACCO Men Promoted

Earl S. Lathrop, Plant Manager, American Chain Division, **American Chain & Cable Company, Inc.,** York, Pa., has announced three promotions.

★ ★ ★

Effective March 1, 1956, **A. M. Roberts,** former Chief Metallurgist for the Chain Division has been promoted to the position of Assistant to the Plant Manager

GLADER NAIL MACHINE

a NAME and MACHINE
that have stood for
DEPENDABILITY since 1887

$ $ $ $ $ $ $ $ $ $ $ $ $
$ our Nail Machine $
$ "KNOW-HOW" $
$ means $$$ for you $
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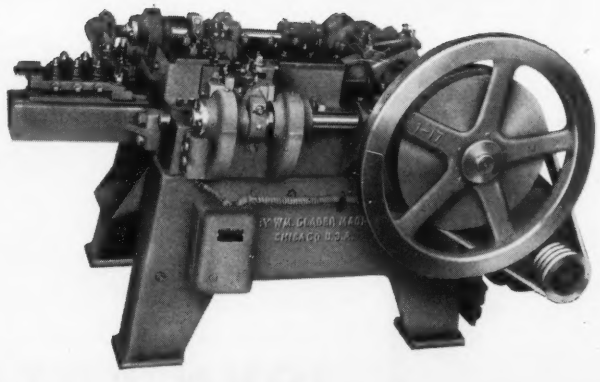


Wm. GLADER MACHINE WORKS 210 N. RACINE AVENUE CHICAGO 7, ILLINOIS

EXPORT DEPT. 122 EAST 42ND STREET • NEW YORK 17, N. Y.

and **C. H. Raab** has been appointed Chief Metallurgist, filling the position formerly held by Mr. Roberts.

★ ★ ★

William B. Ilko has been appointed to the position of Sales Manager, **American Chain Division,** York, Pa. He succeeds **W. D. Kirkpatrick** who is retiring after 41 years of service.

Scott to Head Worcester Engineers

Roger M. Scott, Engineer of the Wire Machinery Division, **Morgan Construction Co.,** Worcester, Mass., was recently elected president of the Worcester Engineering Society. He is a director of the Society and was a member of the General Committee of the Machine Design Conference sponsored by the ASME on April 10 and 11, 1956, at Worcester.

★ ★ ★

Mr. Scott is also a member of **The Wire Association** and in 1954 was Co-Chairman with **Robert C. Peterson,** Manager of **Thompson Wire Co.,** of the Program Committee responsible for the excellent Regional Meeting held in the city on April 22nd and 23rd of that year.

Appoints Canadian Representative

Metal Carbides Corporation, Youngstown, Ohio, announces the appointment of **A. C. Wickman, Limited,** The Queensway, Etobicoke, Toronto, as its sales representative in Canada.

Appointed Specialist in Angier Spiralwrapping Paper and Equipment

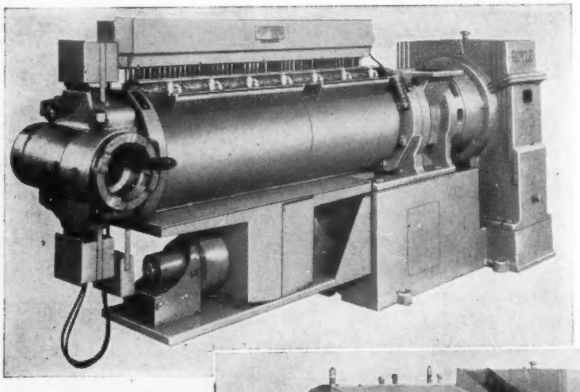
In order to keep pace with industrial needs for Spiralwrapping service and products, **Angier Corporation,** Framingham, Mass., has recently appointed **Raymond O'Brien** as specialist in this particular field. Formerly the Angier sales representative in the metropolitan New York area, he is now based at Framingham. He will, however, travel throughout the country in his sales-service capacity.

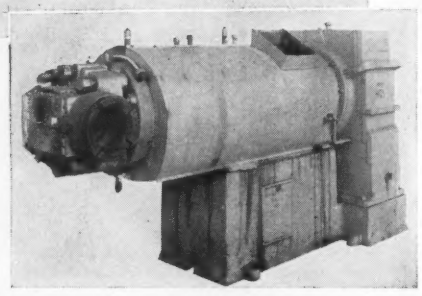
★ ★ ★

On first assuming his duties, he conducted an intensive survey of the market for Spiralwrapping papers and equipment. Results of this survey, coupled with interest generated through Angier's appearance at Chicago's Wire Show, has indicated that the company's potential in this particular product category may further be expanded. Angier manufactures creped papers of all types developed especially for Spiralwrapping applications. In addition, it manufactures machines especially designed to simplify packaging of circular and rod-shaped items.

★ ★ ★

For more information please contact: Mr. Robert A. Mills, Sales Promotion Manager, Angier Corporation, Framingham, Massachusetts.





8½" Spirod extruder with side delivery head for jacketing. Up-graded from circulating type shown to the right.

EVER THINK OF UP-GRADING TO SPIROD®?

Yes, it can be—and is being—done. And Royle's traditional approach to extruder development, the retention of features that have stood the test of time, makes it possible. The one-piece cylinder with built-in hopper is replaced by a separate cast steel hopper section, a cast steel cylinder with deep grooves that create fin-like separations for the rod type heating elements and the selective evaporative cooling equipment. Head and stock screw, as usual, are designed for process requirements.

If you are operating an older type Royle extruder you should investigate up-grading to Spirod—the electrically heated extruder with high velocity evaporative cooling—for maximum efficiency in controlled operating temperatures.

Write for Bulletin # 463

JOHN ROYLE & SONS ROYLE PATERSON N. J. 1880

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London, England — James Day (Machinery) Ltd. — Hyde Park 2430 - 0456
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Los Angeles, Cal. — H. M. Royal, Inc. — LUdlow 9-3261
Tokyo, Japan — Okura Trading Co., Ltd. — (56) 2130 - 2149

Titchener Announces Appointments

E. H. Titchener & Co., Binghamton, New York, announces the following promotions: **Russell F. Schreiber,** former Vice President, to Executive Vice President and Treasurer; **T. W. Whipple,** former Sales Manager, to Vice President in charge of Sales; **Edward T. Wayne,** Design Engineer, to Vice President and Director of Engineering; and **Miss Elsie R. Schaefer,** Personnel Director, to Company Secretary.

★ ★ ★

Paul G. Bach, Madeira, Ohio, and **Foster Callaghan,** Cincinnati, have been named to the field sales staff of **E. H. Titchener & Co.,** Binghamton, N. Y. manufacturers and designers of wire parts and welded wire assemblies.

★ ★ ★

Appointment of the sales representatives, who will cover southern Ohio, southern Indiana, and northern Kentucky, represents a further step in Titchener's current expansion program.

★ ★ ★

The new appointments, said President **Paul F. Titchener,** concur with recent and planned expansions in the company's plant facilities, design service, and field sales staff. The Binghamton firm is a leading designer and producer of wire parts and welded wire assemblies.

Alloy Metal Wire Appoints Chicago Representative

Edward Renz has been appointed sales representative in the Chicago territory for **Alloy Metal Wire Division, H. K. Porter Company, Inc.,** it was announced by **Peter Stefan,** Alloy Sales Manager. He will join **Loy Collingwood** in the Chicago office.

★ ★ ★

Mr. Renz joined the Alloy Metal Wire Division sales staff in September 1954. Prior to that time he was associated in a sales capacity with Whitehead Metal Products Company in Philadelphia for seven years. Mr. Renz received his technical education at Temple University, where he studied metallurgy.

New Works Manager for C.F.&I.'s Buffalo Plant

Carl J. Murray has been appointed Works Manager of the Buffalo, New York plant of **The Colorado Fuel and Iron Corporation's Wickwire Spencer Steel Division,** it was announced by **Hubert C. Smith,** Vice President in charge of operations for the company's Eastern Division.

★ ★ ★

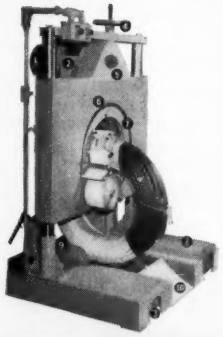
A graduate engineer of Syracuse University, Mr. Murray has been associated with the **Jessop Steel Company** in Washington, Pa., **The Crucible Steel Company** in Syracuse, N Y., and the **Lamson Company** in Syracuse, N. Y.

★ ★ ★

Mr. Smith also announced the appointment of **Vincent G. Galvin** as Superintendent of Industrial Relations at the Buffalo plant.

1 man can operate Angier's NEW UW-10 spiral wrapper . . .

These features make it the most versatile machine available



1. Automatic electric brake.
2. Direct connected high starting torque motor.
3. Shuttle jog control.
4. Vertical shuttle adjustment. (Power drive available)
5. V-Belt shuttle drive (concealed).
6. Ball-bearing shuttle rolls.
7. Forged steel shuttle.
8. Separate motor for feed roll drive (concealed).
9. Horizontal feed roll adjustment (both rolls).
10. Roll-in loading.

Angier Corporation, Framingham 3, Mass.

Angier

GET FACTS ON THE UW-10 AND OUR FULL LINE OF SPIRAL AND BAR PAPER WRAPS.

CAMDEN WIRE CO., INC.

Wire Fabricators

Producers of Quality Fine Wire Copper Conductors

EXTRA FLEXIBLE CONDUCTOR STRANDED OR BRAIDED

MULTIPLE ENDS OF SIZES .008 to .002

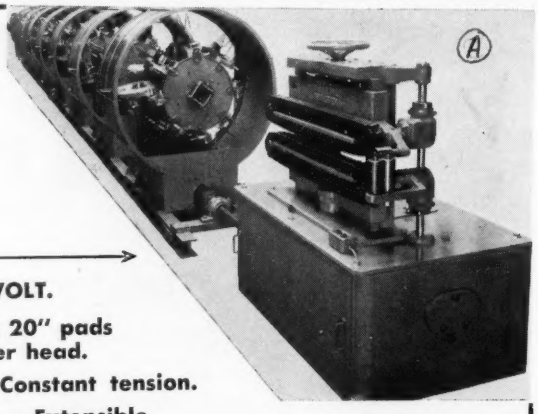
BARE · TIN or LEAD COATED · SILVER PLATED

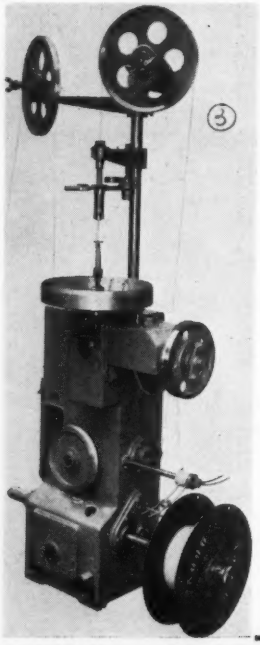
Special Heavy Tinned Conductors for Hook-up Wire

40 MASONIC AVENUE • **CAMDEN, NEW YORK**

NEW...

IN PAPER LAPPING





FOR TELEPHONE

— High speed paper lapping.
— 3,000 r.p.m.
— Movable drum.
— Automatic stop.
— 12" pad.
— Electric counter.
— Central lubrication.

FOR HI. VOLT.

— 8 x 20" pads per head.
— Constant tension.
— Extensible pad centre.
— Individually braked.
— Variable die.
— Caterpillar haul-off.
— P.I.V. drive.
— Automatic stop.

POURTIER MACHINES

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ROMAINVILLE (Seine) **FRANCE**

Personnel Changes in Western Electric

Following a regular meeting of its Board of Directors on April 10, 1956, the **Western Electric Company** announced the election of **Harold V. Schmidt, A. Pope Lancaster,** and **William E. Burke** as Vice Presidents.

★ ★ ★

These changes accompany a realignment as of May 1 of Divisional responsibilities within the Company occasioned by the retirement on July 1 of **Henry C. Beal,** Vice President-Manufacturing. **Arthur B. Goetze** of Short Hills, N. J., now Vice President-Finance, will replace Mr. Beal as Vice President-Manufacturing.

★ ★ ★

Mr. Schmidt, who has been Engineer of Manufacture since 1952, becomes Vice President-Chief Engineer. He joined Western Electric in 1917 at its Hawthorne Works. He has been Superintendent of Factory Planning at Hawthorne Works, Manager of the Tonawanda Plant in Buffalo and Assistant Engineer of Manufacture.

★ ★ ★

Mr. Lancaster, presently Manager of the Company's Works in Kearny, was appointed Vice President-Manufacturing, Eastern Area, and will be responsible for directing activities of Company plants at Kearny, N. J., Allentown and Laureldale, Pa., Baltimore, Md., and Haverhill and Lawrence, Mass. He has been Works Manager of the Kearny Works in New Jersey since 1952.

★ ★ ★

Mr. Burke, now manager of the Distant Early Warning (DEW) Line project which the Company has undertaken for the U. S. Air Force, will become Vice President-Defense Projects. He joined the technical staff at Bell Telephone Laboratories in 1928 and since that time has served as Superintendent of Manufacturing Engineering at the Kearny Works, Assistant Works Manager of the Point Breeze Works and Comptroller of the Manufacturing Division.

★ ★ ★

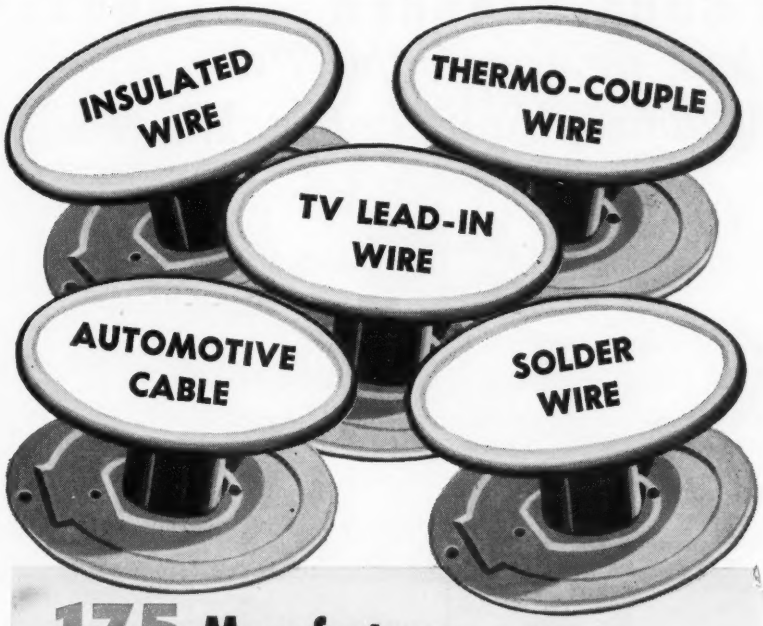
Several related changes are also effective May 1. **Paul A. Gorman** who has been Vice President-Defense Projects will succeed Mr. Goetze as Vice President-Finance. **Hardy G. Ross** who has been serving as Assistant Works Manager at the Kearny Works will succeed Mr. Burke as Project Manager of the DEW Line.

★ ★ ★

Timothy E. Shea, who has been Vice President - Manufacturing, Eastern Area, will become Vice President-Personnel and Public Relations. Succeeding Mr. Lancaster as Kearny Works Manager will be **Arthur P. Clow,** who has been Personnel Director. **W. Clare Brooks,** formerly Assistant Works Manager at the Hawthorne Works, becomes Personnel Director of the Company.

★ ★ ★

Harry S. Snell of Indianapolis,



175 Manufacturers say MASON Spools are best—for less!

These manufacturers specify Mason lightweight, non-returnable, lithographed Spools for performance, appearance and cost!

And while Mason Spool performance speaks for itself, the appearance of Mason Spools speaks for *you* with rich, colorful lithography that assures *instant brand recognition.*

Mason lightweight, non-returnable Spools are available in 5″, 6½″, 8½″ and 10½″ head sizes. All sizes are available with 1⅞″ (Dia.) barrels. The 10½″ head size is also available with a 3½″ (Dia.) barrel. Barrel lengths from ⅝″ to 14″.

Let us know about your spool requirements *now!* Telephone East Providence 1-2810 or write to the address below.

MASON CAN COMPANY

1949 Dexter Road, E. Providence 14, R. I.
Branch Plant — Greenville, Ohio

Assistant Works Manager of the Indianapolis Works, has been appointed Engineer of Manufacture succeeding Mr. Schmidt.

Celanese Adds to Sales Staff

Alexander G. Koos has joined the Plastics Division of **Celanese Corporation of America** as a member of its Sales Development Department staff. He was formerly associated with the Diamond Alkali Company and the Virginia-Carolina Chemical Corporation's Fiber Division.

Screw Company Elects President

The election of **Eugene R. Kramer,** of Cleveland, as President of the **United Screw and Bolt Corporation,** was announced April 18th by the former President, **E. A. Thatcher,** who was elected Chairman of the Board.

★ ★ ★

Mr. Kramer, a director since 1951, has been with the company for 25 years and had been Vice-President since 1948. Other officers of the company who will continue to serve in the same capacities are **V. H. Wilde,** Vice President and Treasurer, **J. E. Tellson,** Vice President, and **Frank J. Foley,** Secretary.

★ ★ ★

The company has offices and manufacturing plants in Cleveland and Chicago and also maintains a sales office and warehouse in New York.

New Utica Representatives

Utica Drop Forge & Tool Corp., Utica, New York, has appointed **Melvin S. Glandon, Philip J. Moore** and **Julian Slezak** as direct representatives for midwest and southwest territories, according to **T. R. Hughes,** Utica vice-president and director of sales.

★ ★ ★

Mr. Glandon will cover the North Texas, Oklahoma, and Arkansas territory, with his headquarters at 301 McMillan St., Waxahachie, Texas. Mr. Moore and Mr. Slezak have been assigned to the Illinois, Northern Indiana and Wisconsin territory.

Metal Carbides Appoints Cleveland Representative

Metal Carbides Corporation, Youngstown, Ohio, announces the appointment of **George J. Borovsky** as a Sales Representative connected with the Cleveland, Ohio, District Sales Office. He was formerly associated with the Kennametal, Inc., Latrobe, Pa., and the Parker Appliance Co.

Riverside Metal Appointment

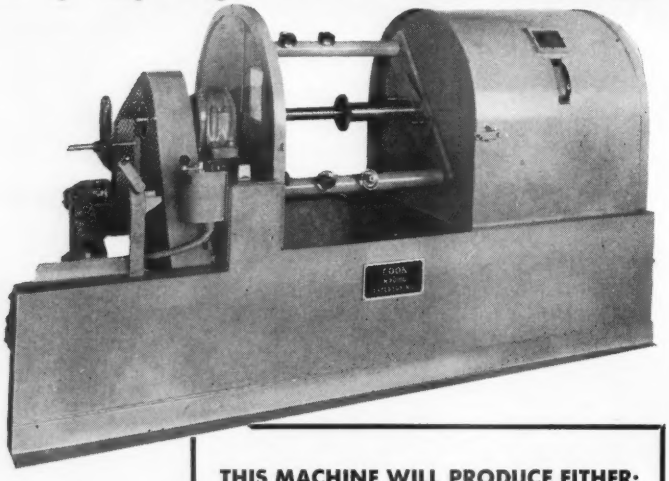
The appointment of **Eugene Salinger** as assistant general manager at **Riverside Metal Division, H. K. Porter Company, Inc.,** Riverside, N. J., has been announced by **W. Harvey Thompson,** the division's vice president and general manager.

Made Chief Engineer of Fastener Firm

Appointment of **Paul Pick** as Chief Engineer of **The Allen Manufacturing Co.,** Hartford, Conn., has been announced by **James G. Osmond,** Allen's president. He succeeds the late **Clarence S. Gates.**

A COOK BUNCHER — STRANDER

Your Answer to the New Military Specification: **MIL-W-5086**



takes less space

Models Available	Capacity
BH-8	45 lbs.
BH-12	90 lbs.
BH-16	200 lbs.
BH-22	500 lbs.
BH-24	1000 lbs.

Write today, for descriptive literature giving details of construction and performance

THIS MACHINE WILL PRODUCE EITHER:

Concentric Wire—Where layers are made up of wires in opposite direction of lay.

Semi-Concentric Wire—Where layers are made up of wires in same direction but with different lay to prevent strand locking.

- **HIGH SPEED**
- **SINGLE TWIST FLYER**
- **AUTOMATIC LAY CONTROL**
- **LARGE TAKE-UP REEL**

A Complete Line of Quality Machinery For The Wire and Cable Industry To Meet Rigid Specifications.

COOK MANUFACTURING CO.

50 EAST 25TH STREET, PATERSON, N. J. • ARMORY 4-6380

Mr. Pick is an engineering graduate of the University of California and has been associated with Allen since 1951.

★ ★ ★

Other appointments included **Edward S. Loika,** chief of production engineering; **E. Russell Carter, Jr.,** to take charge of drafting, engineering order processing, product and tool standards; **Alton W. Gross,** chief metallurgist, heading research, development and metallurgy; **Edward A. Pendleton,** to coordinate all engineering projects; and **Michael Kubick** to supervise sales engineering activities.

Chris J. Witting Elected to NEMA Board

Chris J. Witting, vice president of **Westinghouse Electric Corp.** and general manager of all consumer product divisions, was elected to the Board of Governors of the **National Electrical Manufacturers Association,** it was announced by **Joseph F. Miller,** managing director of NEMA.

Carboloy Adds to Staff

Edward I. Orley, former staff accountant, **Bohn Aluminum & Brass Corp.,** was recently appointed budgets and measurements analyst for **Carboloy Department of General Electric Company,** Detroit.

★ ★ ★

His new duties include special studies and analyses of the organization's performance, and assisting administrative personnel in preparing budgets and forecasts of their activities. He is a business administration graduate of the University of Detroit.

To Handle Extrusion Materials Sales for Bakelite

The appointment of **William J. Canavan** as Manager of the Extrusion Materials Division, Bakelite Company, is announced by **C. W. Blount,** Vice President in Charge of Sales for this **Plastics Division of Union Carbide and Carbon Corporation.** In this new appointment, Mr. Canavan will be responsible for the sale of the various plastics produced by Bakelite Company to a wide variety of manufacturers, including wire and cable, pipe and related fields. A graduate of Stevens Institute of Technology, Mr. Canavan joined Bakelite Company in 1944.

To Head Purchasing for Northwestern Steel & Wire

Announcement has been made of the appointment of **B. C. Kays** as Purchasing Agent for the **Northwestern Steel and Wire Company,** Sterling, Ill.

J & L Appoints Production Men

William L. Cressman has been appointed assistant general manager of the Products Divisions of **Jones & Laughlin Steel Corp.,** Pittsburgh, Pa.

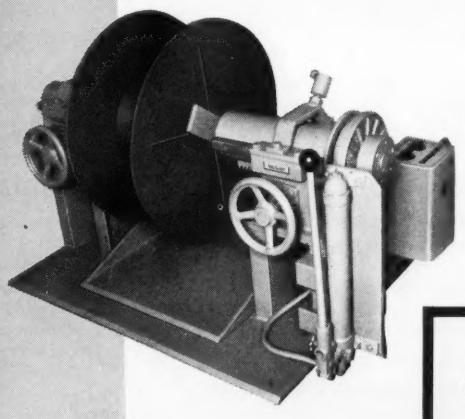
Think of W I M for:
Fast Action, Shaftless
PAYOFF STAND

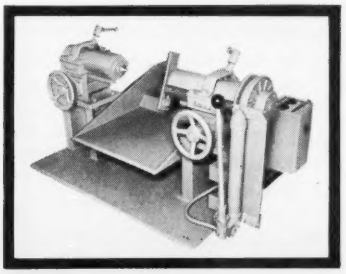
1: Electric Tension Control — dial operated.
2. Hydraulic Lift.
3. Ball-Bearing Mounted Spool Arbors.

New, modern—the WIM Model A Shaftless Payoff Stand — offers smooth, easy and continuous tension control; simple hydraulic lift loading; and faster action.

The unit will handle any spool size from 16" to 36" and up to 1000 lbs. total weight. Trouble-free operation is assured by ball bearing mounted spool arbors.

Think of WIM for the finest wire handling machinery.





WIM Model A Shaftless Payoff Stand
Write for complete details.

WIRE INSULATING MACHINERY INC.
DIVISION: MACHINERY ELECTRIFICATION, INC.
NORTHBORO, MASS. 35 HUDSON STREET

New Circular on Hand Feed Thread Rolling Machines

A new 12-page booklet published by the **Waterbury Farrel Foundry & Machine Co.** covers the complete line of hand feed threaders built by the company.

★ ★ ★

The machines in this circular are the reciprocating type using conventional flat dies and are especially designed to roll greater lengths of thread than can be done commercially on automatic thread rollers. Photographic illustrations show the wide variety of threading and other operations that can be performed.

★ ★ ★

The text covers Operation, Tooling, Lubrication, Capacity and Drive arrangements in general and gives specific descriptions of each of the four types of machines shown. Illustrations and complete tables of specifications covering various sizes of horizontal hand feed, horizontal-side hand feed, horizontal hand feed with deep dies and inclined-side hand feed thread rollers are given.

★ ★ ★

Also included is a list of the various types of cold heading equipment, power presses, wire mill equipment and rolling mill machinery produced by Waterbury Farrel.

★ ★ ★

Free copies of this booklet can be obtained by requesting circular number 931-A-2 from the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

Standardize on ACROPAK* Spools!

Only ½ the Weight!

YET STRONG, TOUGH, RIGID . . *LONGER LIFE*

ACROPAK Spools will help you cut wire packaging costs because they give longer service, require less maintenance and cost less to ship. They're strong. They'll take repeated shippings and still run true on the arbor. They're machined to close tolerances. You can run them at high production speeds with fewer snags, less toe-out and minimum end breakage.

THEY CUT YOUR SPOOLING COSTS

Best proof of ACROPAK superior performance are the millions of these spools now used by the biggest names in the wire industry. We've proved it to them—let us prove it to YOU.

- Light Weight
- Precision built
- Reduced cost
- Longer life
- Extra strength
- Dynamic balance
- Greater production
- Low cost reconditioning
- Less maintenance
- Attractive packaging

★ We also make a complete line of heavy-duty shop processing STEEL SPOOLS built to the same high standards of accuracy and rigidity as the famous Acropak aluminum spools.

ACROMETAL PRODUCTS INC.
Division U S Bobbin and Shuttle Co., 616 Fifth Street N., Minneapolis 1, Minn.

Okonite Moving Hazard Division to New Brunswick

More than 600 employes of **Hazard Insulated Wire Works** division of **Okonite Company,** Wilkes-Barre, received notification by mail that within the year all operations at the local plant will be transferred to the firm's new plant in New Brunswick, N. J.

★ ★ ★

Okonite president **R. S. Keefer,** in letters to employes, said that insofar as possible jobs at New Brunswick "will be filled by present employes who are available and willing to make the move."

★ ★ ★

The Wilkes-Barre plant has been in operation since 1870, with Okonite taking over in 1927.

Dozen Wire Types Described in New Bulletin

A new bulletin has been issued by the **Webb Wire Division** of **The Carpenter Steel Company,** New Brunswick, N. J., describing a variety of types of stainless steel wire. It includes the analyses, tensile strengths, physical properties and gauges of 12 types of stainless wire most generally used in the manufacture of wire products. Specifications for all of the wire types are given in easy-to-read chart form. Each of the wire grades covered is described in terms of distinctive characteristics and suggested end use. The entire grouping is broken down into austenitic, martensitic and ferritic classifications.

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,740,134, SPRING ASSEMBLY FOR MATTRESSES, patented April 3, 1956 by Eugene Joseph Hood, Carthage, Mo., assignor to Frank B. Williams and Harold E. Williams, Carthage, Mo.

The assembly includes helical springs in parallel rows, with parallel helical binder coils extending about the upper and lower marginal edges of the assembly and joining the outer portions of the top and bottom loops, there being other helical binder coils, coiled about the overlapping portions of corresponding springs. Sinuous wires extend across the upper surface of the assembly generally parallel to the parallel binder coils.

★ ★ ★

No. 2,740,136, METHOD OF PRODUCING BLANKS FOR ROLL THREADED SCREWS AND THE LIKE BY A COMBINED FORGING AND DRAWING ACTION, patented April 3, 1956 by Serafino Chiaberta and Pio Chiaberta, Milan, Italy, assignors to Bulloneria E. Viterie Italiana B. E. V. I., Milan, Italy.

A process for reducing the diameter of spaced portions of a continuously moving length of stock of circular cross-section and simultaneously severing and pointing the severed length of stock is disclosed.

★ ★ ★

No. 2,740,148, BRUSH AND METHOD OF MAKING SAME, patented April 3, 1956 by Brooks E. Nelson, Cleveland, and Ruben O. Peterson, University Heights, Ohio, assignors to The Osborn Manufacturing Company, Cleveland, Ohio, a corporation of Ohio.

The method of producing a brush element includes longitudinally advancing a continuous flat metal strip, punching a series of closely spaced holes in such strip and inserting bundles of wire brush material through the holes so that the respective ends of each such bundle protrude on opposite sides of such strip and doubling and twisting such bundles on themselves about the edge of such strip to form twisted tufts extending generally parallel to one another in the same direction from such supporting strip.

★ ★ ★

No. 2,740,373, WIRE ENAMELING APPARATUS, patented April 3, 1956, by Clarence Wagner and Jay Essenbager, Muskegon, Mich., assignors to Anaconda Wire and Cable Company, a corporation of Delaware.

Apparatus for applying a coating of enamel to a moving wire is disclosed and comprises an applicator for applying liquid enamel to the surface of the wire, a drier for drying the coating of liquid enamel applied to the wire, an absorptive-surfaced wiper roll in contact with the moving wire between the drier and the applicator, and an absorptive-surfaced blotter roll in contact with the moving wire and with the wiper roll between the wiper roll and the drier, the blotter roll being rotated at a peripheral speed equal to the rate of travel of the moving wire and in the direction corresponding to the direction of movement of the wire where it is in contact therewith and the wiper roll being rotated by the blotter roll in the opposite direction.

★ ★ ★

No. 2,740,459, METHOD AND APPARATUS FOR BUILDING WIRE REINFORCED CONVEYOR BELTS, patented April 3, 1956 by Karl B. Kilborn and Paul D. Suloff, Akron, Ohio, assignors, by mesne assignments, to The Goodyear Tire & Rubber Company, a corporation of Ohio.

More specifically an important object of the invention is to tension and align parallel tension elements for a wire belt structure. There are 33 claims.

If you are still using costly diamond dust for refinishing your wire drawing dies, you'll be amazed at the savings you can make by switching to NORBIDE Abrasive. Wire mills everywhere have found that this abrasive — the hardest manufactured abrasive commercially available — is ideal for ripping and semi-finishing operations.

Many of our customers order NORBIDE Grain in 100 lb. drums. Many others order and re-order ¼ lb. and ½ lb. cans. No matter what your requirements are we can fill your order promptly from stock.

For details and prices on this cost-cutting abrasive write for Form 559.

NORTON BORON CARBIDE

NORTON COMPANY
45 New Bond St. • Worcester 6, Mass.

NORBIDE® | *The hardest manufactured abrasive commercially available!*

No. 2,740,601, WOVEN WIRE FABRIC, patented April 3, 1956 by Albert S. Snapp, Worcester, Mass., assignor to G. F. Wright Steel & Wire Co., Worcester, Mass., a corporation of Massachusetts.

An open mesh wire fabric is disclosed, including a set of spaced parallel longitudinal warp wires of uniform circular cross section, a succession of spaced transverse filling or weft wires interwoven in over-and-under relation with these warp wires and projecting at both ends therebeyond, and a pair of outermost flexible warp wires along each side of the set and also crossed by the weft wires, these two outermost warp wires being of flat strip form disposed flatwise in the fabric's plane, and of a thickness no greater than the diameter of the circular-section warp wires.

★ ★ ★

No. 2,741,019, METALLIC COATING FOR WIRE, patented April 10, 1956 by Charles L. Faust, Columbus, Ohio, assignor to the United States of America as represented by the Secretary of the Army.

A solderable copper wire conductor said to be of high resistance to humidity and fungal growth is disclosed comprising a first coating of an electrodeposited lead film of a thickness from 0.00003 inch to 0.00006 inch and a second coating of electrodeposited tin having a thickness from 0.000005 inch to 0.00002 inch.

★ ★ ★

No. 2,741,081, STRANDING MACHINE, patented April 10, 1956 by Dana B. Carleton, Trenton, N. J., assignor to United States Steel Corporation, a corporation of New Jersey.

Included is a take-up reel rotatably mounted in a frame and adapted to tension a stranded wire structure and its components for pulling them through a closing device for closing the components of the structure into the desired stranded form.

★ ★ ★

No. 2,741,293, MACHINE FOR STRAIGHTENING SHAPED WIRES, patented April 10, 1956 by Walter Siegerist, University City, Mo., assignor by mesne assignments, to Blaw-Knox Company, Pittsburgh, Pa., a corporation of Delaware.

An adjustable machine is provided for straightening wires of various sizes.

★ ★ ★

No. 2,741,436, WIRE WRAPPING TOOL FOR FINE WIRES, patented April 10, 1956 by Emil Belck, Flushing, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

There are eleven claims to this patent. The tool includes a wire guiding slot adjacent and in communication with a wire receiving slot, with the latter being substantially wider than the diameter of the wire to be wrapped and the wire guiding slot but slightly wider than this diameter.

★ ★ ★

No. 2,741,437, CONSTANT TENSION TAKE-UP AND LET-OFF MECHANISM, patented April 10, 1956 by Howard H. Haworth, Fountain City, Ind., assignor to Belden Manufacturing Company, Chicago, Ill., a corporation of Illinois.

Adapted for wire handling machines, the mechanism includes an electro-magnetic clutch and an electro-magnetic brake providing a coupling between an electric motor and a reel-carrying shaft.

★ ★ ★

No. 2,742,687, LOW TIN CONTENT, DURABLE, TINNED COPPER CONDUCTOR, patented April 24, 1956 by Waldemar P. Ruemmler, Dyer, Ind., assignor to the United States of America as represented by the Secretary of the Army.

The conductor consists of a copper wire core base, an electro-deposited iron barrier layer thereon having a thickness of about 0.00003 inch, and a layer of electrodeposited tin on this iron layer having a thickness of between $2.5x10^6$ and $5x10^6$ inch.

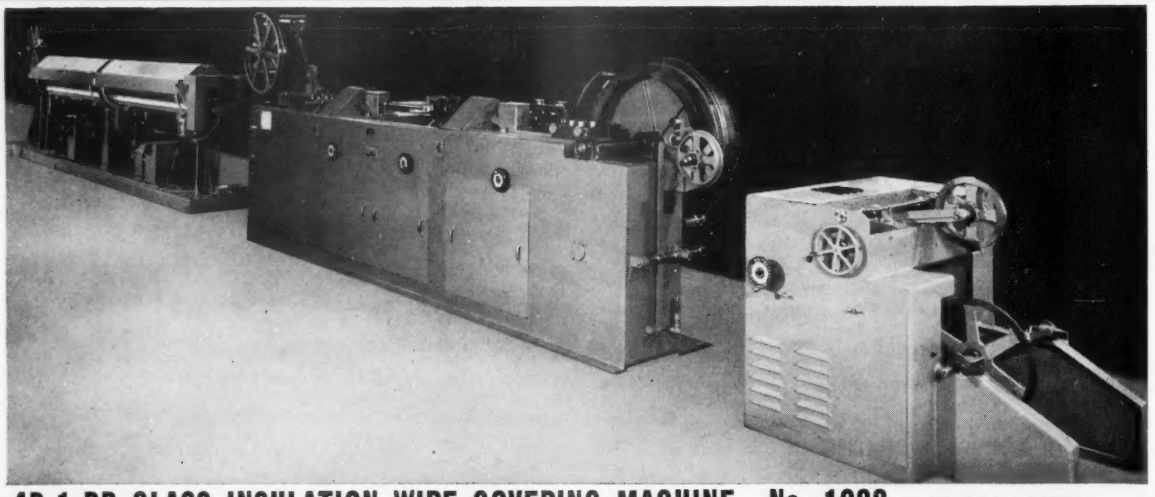
★ ★ ★

No. 2,742,771, SPOON HOLDER FOR POTS AND PANS, patented April 24, 1956 by Lloyd J. Negaard, Minneapolis Minn.

This holder consists of a one-piece length of wire formed to provide an attachment for the wall of a saucepan or the like.

★ ★ ★

No. 2,742,851, MACHINE FOR TYING WIRE COILS, patented April 24,



4D-1-BB GLASS INSULATION WIRE COVERING MACHINE **No. 1088** Patented Aug. 3, 1943

WITH VARIABLE SPEED DRIVE.
TORQUE MOTOR DRIVEN TAKE-UP REEL STAND
BALL AND ROLLER BEARING MOUNTED
BAKING OVEN WITH DOUBLE VARNISH APPLICATOR
AND AUTOMATIC TEMPERATURE CONTROLS.

WIRE DRAWING, ENAMELING, TINNING, INSULATING,
TAPING, GLASS-COVERING, PANNING AND ALLIED MACHINERY

EST. 1855 AIMCO INC. 1915
"American" AIM INSULATING MACHINERY COMPANY
REG. U.S. PAT. OFF.
FAIRHILL AND HUNTINGDON STREETS
PHILADELPHIA 33 PENNSYLVANIA U.S.A.

1956 by George R. Fryer, Ansonia, Conn.

There are twelve claims to this machine for twisting together the ends of a length of wire.

Electric Wire Firm Changes Name

The American Phenolic Corp., 1830 South 54th Ave., Chicago 50, Ill., has announced that its corporate name was officially changed on April 16, 1956, to **Amphenol Electronics Corporation.**

★ ★ ★

The change of name, the announcement states, does not alter the identity or character of the corporation, which is a producer of electronic components, R. F. coaxial cable, cable assemblies, radio and industrial connectors, TV, FM and communication antennas and other products.

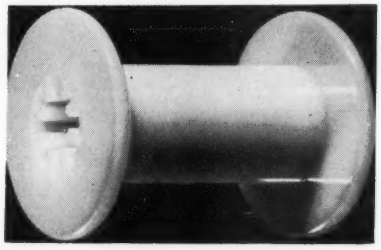
Nylon Wire Braider Spools

A new plastic spool for wire braiding, after a long period of field tests, has been found to have a number of outstanding advantages.

The spools are made of Dupont's tough Zytel Nylon, the heads of which, when loaded, will not become distorted or deformed if accidentally dropped or mishandled. They are injection molded for dimensional uniformity, which assures a more accurate put-up.

★ ★ ★

Breakage of these spools is rare, less than 1% per year having suffered this damage according to test installation reports. Their extraordinary durability contributes to operating economy, in contrast to expensive replacement and maintenance caused by the bent heads of metal bobbins. First cost, too, is lower than that of the metal product.



Plamenco Wire Braider Spool. * * * *

For further details, please write to **Nylaclad-Plamenco Div., Plastic Mold & Engineering Co.,** 157 Clifford St., Providence 3, R. I.

Catalog on Printing Wheels and Machines for Electric Wire

The Duncan M. Gillies Co., Inc., 66 Central St., West Boylston, Mass., has issued a catalog describing and illustrating its line of engraved marking wheels and machines for printing code identifications and manufacturers' names on electric wire and cable.

★ ★ ★

The wheels are made of hardened tool steel to give long life and machines are offered that print on one or two sides of the wire. Wheels are the concave type so that printing may be done in large, legible lettering.

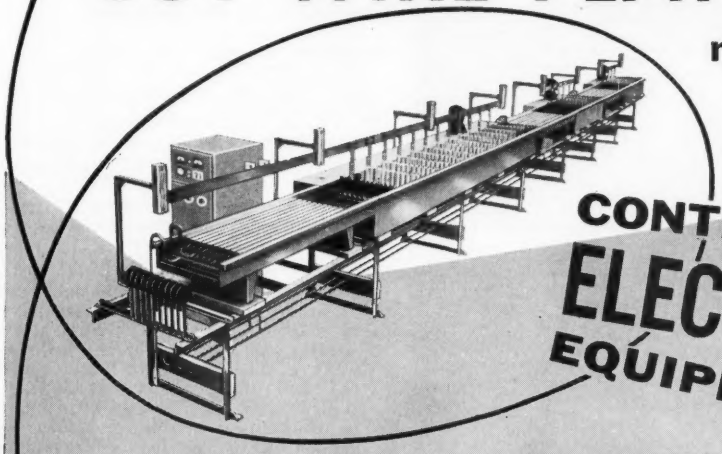
★ ★ ★

A feature of the machines is that parts and ink may be easily and quickly disassembled for cleaning.

★ ★ ★

CUT WIRE PLATING COST!

maintain uniformity on copper and aluminum wire



CONTINUOUS U.I.E.C. ELECTROPLATING EQUIPMENT

This low cost equipment performs uniform high quality work at speeds that mean real savings. Simple to operate. We furnish complete installation.

Write today to:

UNIVERSAL INDUSTRIAL EQUIPMENT CO.

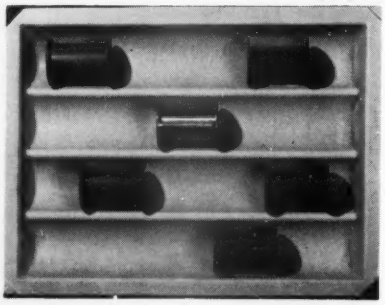
SECAUCUS, NEW JERSEY

Sole agent in Canada: E. V. LARSON CO., LTD., TORONTO, CANADA

The catalog will be sent upon request to the company.

Shipping Container for Fine Wire Spools

A solution to both handling and shipping problems for spools of fine wire has been revealed by the introduction of a fiberglass reinforced polyester spool tray. Designed to solve the major problems of light weight, durability, and cleanliness, the fiberglass spool trays also nest when not in use, thus reducing storage space. Unusual design permits this new product to be used as either a tray or a cover and with locking corners



and ridges they cannot slip.

★ ★ ★

Available in colors for easy identification, the trays weigh less than two pounds and may have names or code numbers molded in. Reports from users have noted freedom from splinters, reduction of maintenance and improved quality control. The tray shown is 15″ x 20″.

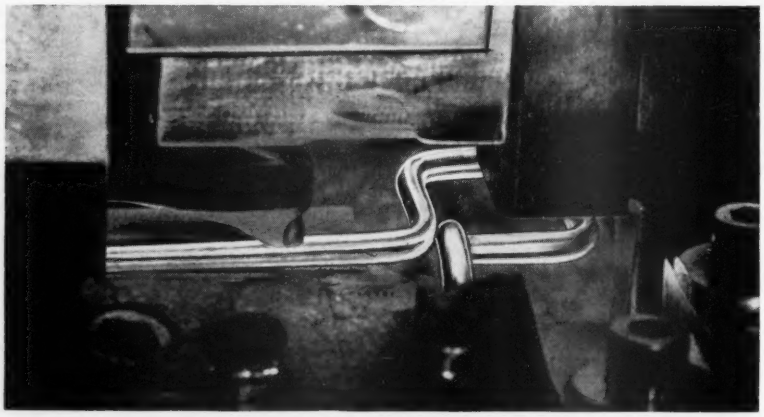
★ ★ ★

Further information may be had by writing **Firmaline Products, Inc.,** Midland Park, N. J.

NILSON 4-SLIDES PAY OFF 4 WAYS

• BIG PROFITS • BIG PRODUCTION

• BIG SAVINGS • BIG GAIN IN ACCURACY



Forming Operation: Meter Shunts of 3/16″ Wire Stock

WHY NILSON IS TOPS FOR 4-SLIDES:

Nilson 4-Slides are built for rugged duty

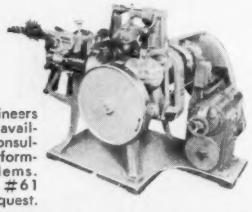
Form both ribbon metal and wire stock

Press capacities 8 to 75 tons, wire diameter to ½″

16 Models Available, Including Combinations of Horizontal Press and 4-Slide

YOU PROFIT BY:

Automatic Operation • Increased Production • No Secondary Handling • Improved Products • Fewer Rejects • Lowest Initial Cost



Nilson engineers are always available for consultation on forming problems. Bulletin #61 sent on request.

Nilson's 3 tilt and 3 stationary reels handle wire or ribbon stock coils up to 500 pounds.

A.H. NILSON MACHINE COMPANY

1516 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

ABSTRACTS

These abstracts are published through the courtesy and with the permission of the Industrial Diamond Information Bureau, 34 Holborn Viaduct, London, E.C.1, England. Inquiries regarding them should be directed to the Bureau.

ELECTROTINNING TIGHTENS WIRE COATING CONTROL

Am Electroplaters' Soc. Steel 1956 Vol 138 (3) pp 90-91 (Jan 16)

Electrotinning of copper wire used increasingly as substitute for hot dipping. Wire plating line developed, using stannous fluoborate, claimed to give tin savings of about 2/3. Critical tanks are those before and after tin plating, economy demanding min. loss of plating solution. Diamond dies set in Lucite used for this purpose. They follow each tank, having dia 0.0005 in. greater than wire. When wire finer than 24 gauge required, heavier gauges (12 to 20) plated with heavier tin deposits, drawn to final size and annealed. 2 illustr. 1 table.

PROBLEMS OF WEAR ON DRAWING DIES MADE OF HARD METAL CARBIDES

A. Bujok. Mechanik 1954 (10) pp 383-388; Polish Techn. Abstr. 1955 (4(20)) p 65 (Original in Polish)

Most serious loss from rapid wear of hardmetal drawing dies is interruption of production when worn dies have to be changed (3 to 30 min.), and not cost of dies themselves. Factors influencing wear of die divided into 2 main groups: (a) faults in construction of die and unskilled operation during drawing; (b) faults due to operating conditions which include badly chosen lubricants, low quality surface of wire to be drawn, and unsuitable number of drawing steps and drawing speeds.

THE MANUFACTURE AND PROPERTIES OF HIGH-STRENGTH NICKEL-TUNGSTEN ALLOYS

M. Davis, C. E. Densem (Services Electronics Res. Lab., Admiralty), J. H. Rendall (NPL). Inst. Met. Journ. 1956 Vol. 84 (6) pp 160-164 (Feb).

Nickel-tungsten alloys (5 to 40 wt-% tungsten) prepared by powder metallurgy and successfully worked into fine

gauge wire and strip. Wires successfully cold drawn down to 0.001 in. dia. by conventional methods. Sintered carbide dies used for single-die drawing down to 0.020 in. wire, in steps of 0.004 in. with anneals between draws. Diamond dies for finer gauges. Reductions of 50% between anneals satisfactory with light drafts; 0.010 to 0.0068 in. required 4 steps.
Vickers diamond pyramid hardness (1 kg load) plotted against annealing time for strip in hard-rolled condition. 7 illustr., 5 ref., 2 tables.

PRECISION MEASUREMENT OF WIRE DRAWING DIES

T. Hisamoto, K. Kakizaki, Hitachi Rev. 1954 (6) pp 127-133; Ind. Diamond Rev. 1956 Vol 16 (183) pp 25-28 (Feb)

Japanese scientists made a systematic study of the metrology of small dies comprising: (a) dia. of die hole, (b) die angle (entrance angle, reduction angle), (c) roughness of hole surface, (d) curvature of die and length of bearing, and (e) circularity of die hole. In survey tables, present die hole measuring methods and their main characteristics described; and principles of tracer type instrument for die curvatures and die angles, instrument for recording surface roughness of die hole, and optical angle measuring instrument. 4 illustr., 1 ref., 2 tables.

ULTRASONICS: HOW IT WORKS AND WHAT IT DOES

A. Murdoch jun. Am Machinist 1956 Vol 100 (1) pp 96-104 (Jan)

Acoustic system comprising tunable ultrasonic oscillator, power amplifier, transducer and liquid container produces low frequency vibration which, with proper solvent, cleans almost anything, including diamond dies for fine wire drawing. Research and experiments required for large-size reasonably priced transducers. 8 illustr.

FRAGMENTATION IN TUNGSTEN CRYSTALS

G. D. Rieck (Philips Res. Lab., Eindhoven). Acta Metall 1956 Vol 4 (1) pp 47-51 (Jan)

In making filaments for incandescent lamps, tungsten used to which dope added for improved life properties. This largely evaporates during preparation (leaving 99.99% pure W) but residue affects recrystallization. After recrystallization of doped polycrystalline tungsten wire, crystals of up to 1 to 10 mm length found. On testing, these showed special fragmentation with small angular differences. As inclusions in wire will have been stretched out in direction of wire during drawing, predisposition of crystals to break along planes parallel to axis assumed. 7 illustr., 6 ref.

WIRE-DRAWING LUBRICATION . . . WHERE DO WE GO FROM HERE?

R. Tourret. Wire Ind. 1956 Vol. 23 (265) pp 41-44, 56 (Jan.)

Appreciable die life increases possible if means found to apply soap continuously to wire surface. Extreme-pressure lubricants, ie those containing sulphur, chlorine or phosphorus additives, are ineffective, due to low temp of wire before entering die and quick passage through it. Tungsten carbide is relatively inert to EP additives, diamond even more so; protective film would be worn away rapidly. Major advances in lubricant types difficult to visualize; adaptation of drawing mechanisms to available lubricant types desirable. Full hydrodynamic rather than basically boundary lubrication would be beneficial. Suitable design of die holder can automatically induce hydrodynamic lubrication with liquid lubricant. 6 illustr., 5 ref.

ISOTOPES: MAY MEAN BETTER WIRE

Am Steel & Wire Div, US Steel Co—Battelle Mem Inst. Iron Age 1955 Vol 176 (24) p 63 (Dec 15)

Lime used as lubricant during wire-drawing but must be completely removed before coating. This aided by use of radioactive isotopes, capable of detecting lime residue down to 0.000025 in. 2 illustr.

STUDIES ON THE WIRE DRAWING WITH BACK TENSION. I. ON PURE IRON WIRE. II. ON CARBON STEEL WIRE

I. Gokyu, T. Kitsukawa (II only). Nippon Kinzoku Gakkai-Si 1952 Vol. 16 pp 674-679; 679-682; abstr. Iron & Steel Inst Journ 1956 Vol 182 (2) p 228 (Feb.) (Original in Japanese)

Various advantages of back-pull drawing confirmed.

TREND OF RESEARCHES ON PLASTIC WORKING OF METALS

M. Masuda. Jap. Soc. Mech. Engs. Trans. 1954 Vol. 20 (98) pp 629-630 (Oct.); noted Jap. Sci. Rev: Mech. & Electr. Engg. 1955 Vol. 1 (2) p 141 (July)

TUNGSTEN FILAMENTS

Micro Wire Stranding Co. Chem. & Engg. News 1956 Vol 34 (5) p 510 (Jan 30)

Wire filaments of 99.95% tungsten

CHECK LIST FOR
PLYMKRAFT
IMPROVED CABLE FILLER
Samples supplied upon request
Made to fine tolerance
Always uniform
Available in put up that works best on user's equipment
Takes any type treatment—wax, jute saturant, anthracene
Made to user's specifications if desired
Backed by the Plymouth Cordage Company, makers of quality products since 1824
Write to: PLYMKRAFT DIVISION
Plymouth Cordage Company
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Warwick, Va.
PLYMOUTH
1824

made in single strand or stranded cable from 0.0005 to 0.250 in.

THE CALCULATION OF WIRE DRAWING FORCE. I. THE CASE OF CONVENTIONAL WIRE DRAWING WITH WORK HARDENING. II. THE CASE OF WIRE DRAWING WITH BACKPULL

K. Nakamura, H. Takahashi, J. Kurihara (I only), S. Miyoshi (II only). Journ. Mech. Lab. (Tokyo) 1955 Vol. 9 pp 36-41; 42-46 (Jan); abstr. Iron & Steel Inst Journ 1956 Vol 182 (2) P 228 (Feb.)

Formula for drawing force derived on basis of Davis and Dokos analysis of plastic deformation for work-hardening metal, corrected for additional deformation with large die angles. This extended to case of drawing with backpull, and tested experimentally.

STUDY ON THE INTERNAL FRICTION OF CARBON STEEL WIRES IN THE PROCESSES OF COLD DRAWING.

T. Nishihara, H. Miki. Kyoto Univ. Engg. Res. Inst. Bull. 1954 Vol. 5 pp 17-20 (Mar); abstr. Iron & Steel Inst. Journ. 1956 Vol. 182 (2) p 228 (Feb) (Original in Japanese)

THE PRODUCTION OF PATENTED WIRE FOR VALVE SPRINGS

O. Page. Frederick Smith & Co. Wire Manufacturers Ltd. 1955 (Mar. 30); abstr. Iron & Steel Inst. Journ. 1956 Vol. 182 (2) p 228 (Feb.)

Stages of manufacture described, with particular ref. to metallurgical controls. Details of suitable grit sizes for removing specified amounts of decarburized skin during grinding operation.

ON THE EFFECTIVENESS OF APPLYING BACK-PULL IN WIRE DRAWING

L. I. Perlin. Stal' 1955 Vol 15 (11) p 1031; DSIR Transl. Cont. Lists Russ. Period 1956 (83) p 104 (Feb.) (Original in Russian)

ABRASION OF DIAMOND DIES

L. S. Schultink, H. L. Spier, A. van der Wagt. Ind. Diamond Rev. 1956 Vol. 16 (183) pp 29-30 (Feb.); (184) pp 51-53 (Mar.)

6 illustr. See Bibl Ind. Diamond Appl. 1955 Vol. 12 p B136.

HIGH SPEED DRAWING MACHINE

M. A. Sonkin, A. S. Filatov. Vestnik Mash 1955 Vol. 35 (5) pp 14-17; Inhaltsverzeichnisse sowjet Fachzeits 1955 Vol 4 (12) p 1892 (Dec) (Original in Russian)

Description of wire drawing machine with 5 drawing dies and working speed of 15 to 17 m/sec, for drawing steel wire, having 6 drums with parallel axis, each driven by electric motor. Method for calculating power requirements for wire drawing.

THE CORROSION OF MINE CABLES AND ITS CAUSES

J. Teindl, E. Hila. Hutnicke Listy 1956 Vol. 11 (2) pp 77-86 (Feb.). (In Czech; summaries in Russian, German, English, French)

Important factors causing corrosion found to be surface cracks of drawn and laminated wires, quality of drawing dies, material structure, martensite development, and surface protection of wire by polishing and zinc plating. 28 illustr., 29 ref., 4 tables.

MECHANICAL PROPERTIES OF STEEL WIRE DRAWN BY BACK TENSION WIRE DRAWING

T. Ueda, K. Asakura. Osaka Univ. Techn. Rep. 1954 Vol. 4 pp 337-345 (Oct.); abstr. Iron & Steel Inst Journ 1956 Vol 182 (2) p 229 (Feb.)

INCREASE OF DIE LIFE AND SAFETY IN THE OPERATION OF WIRE DRAWING MACHINES

Yu. N. Volkov. Stal' 1955 Vol 15 (11) p 1028; DSIR Transl. Cont. Lists Russ. Period 1956 (83) p 104 (Feb.) (Original in Russian)

ADVANCED EXPERIENCE WITH THE OPERATION OF WIRE DRAWING PLANTS

V. I. Volobyev. Stal' 1955 Vol 15 (10) p 922; DSIR Transl. Cont. Lists Russ. Period 1956 (83) p 102 (Feb.) (Original in Russian)

FINE WIRE DRAWING MACHINES FROM THE GRUENA DRAWING MACHINE WORKS. Die Feinstdraht-Ziehmaschine des Drahtziehmaschinenwerkes Gruena

Anon. Maschwelt & Elektrotechnik 1956 Vol 11 (¾) pp 52-53 (Feb.) (In German)

Further development of kratos wire drawing machine. Die holders perform reciprocating movement to reduce wear of drawing cones. Change of stroke and wire displacement carried out hydraulically.

WET COPPER WIRE DRAWING

Anon. Wire Ind. 1956 Vol. 23 (265) p 71 (Jan)

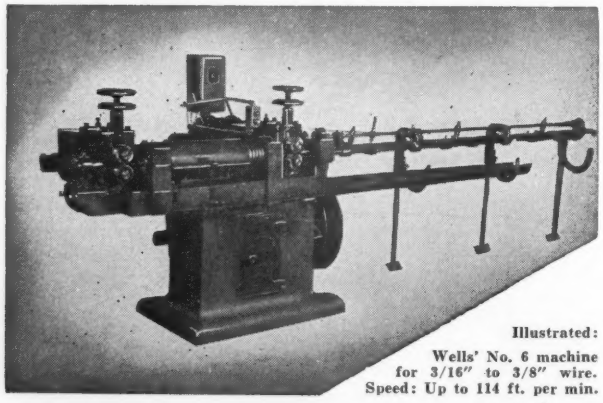
Summary of part of booklet, 'Lubrication in wire drawing', published by Brit Diamond Die Fed.

Experience • Reputation • Workmanship

HAVE ALL COMBINED TO MAKE

WELLS STRAIGHTENERS & CUTTERS

NOTED FOR DEPENDABILITY SPEED AND ECONOMY



Illustrated: Wells' No. 6 machine for 3/16" to 3/8" wire. Speed: Up to 114 ft. per min.

WELLS MACHINES ARE PREFERRED WHERE CONTINUOUS HIGH PRODUCTION AND ACCURACY ARE FACTORS OF IMPORTANCE

TIME-TRIED TESTED & TRUE.

WELLS STRAIGHTENING AND CUTTING MACHINES have won the reputation of being highly dependable, with ability to stand up even on the most trying and difficult jobs. The satisfaction that our customers enjoy can be yours, if you equip your plant with WELLS machines.

The No. 6 model illustrated above will cut in lengths of 7½" to 25'. A full line of WELLS machines is built for all gauges of wire and straightening and cutting jobs.

Write for catalog showing all machines

Frank L. Wells Company

5821 FIFTH AVENUE • KENOSHA, WISCONSIN

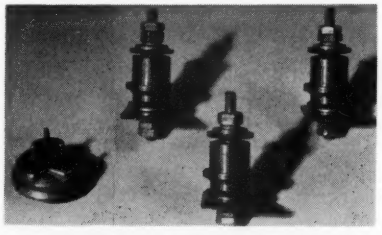
Builders of Fine Wire Working Machinery

New Three Stand Tandem Wire Flattening Mill

The Fenn Manufacturing Company, Newington, Conn., leading manufacturer of metal forming equipment, has announced a new three stand tandem wire flattening mill incorporating the most advanced rolling mill features. Designated as Model #082-062-062 this mill has a common base, central coolant and lubrication systems. The latter is fully pressurized to all roll bearings and pinion stand gears. The first mill stand has 8″ diameter rolls while the second and third mill stands have 6″ diameter rolls will power screw down. This new Fenn mill has synchronized drive to 1000 FPM and features shell rolls for rolling a shape other than square or rectangular, a slitter-trimmer and a scrap cutter for continuous processing of wire in 300 pound coils.

Design Important with Stainless

Here is a good example of how a product was made smaller and more efficient by the use of stainless steel.



The small plug at far left in the photograph replaced three other fittings as hermetically sealed terminals for refrigerator compressors.

★ ★ ★

The new terminal is made of cold rolled steel, glass and Type 446 Armco stainless steel wire. Advantages of the stainless wire are reported to be: (1) same co-efficient of expansion as the other materials; (2) ample corrosion resistance without plating; (3) adequate electrical conductivity.

★ ★ ★

This idea is said to be adaptable to other situations where electricity must be conducted through a sealed metal wall.

National-Standard Introduces Nickel and Brass Coated Steel Wire

Commercial availability of Fernicklon nickel-plated steel wire with up to 10 per cent nickel coat has been announced by **National-Standard Company,** Niles, Mich., leading producer of specialty wire for industry. It can be used wherever combinations of strength, corrosion resistance and lustrous finish are desirable.

★ ★ ★

Significant savings of scarce nickel are promised by the jacketed material. In the lamp, radio and television industry, nickel-coated steel wire has proved highly successful in grid supports, lamp leads and small parts—at a saving of up to 95 per cent nickel metal.

★ ★ ★

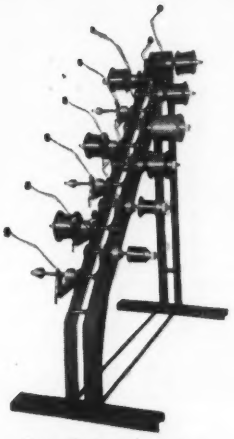
Brass-coated wire is also available—in sizes from 0.072-inch to 0.310-inch. It is recommended only for decorative effects in the furniture and accessories field. Typical products include curtain rods, drapery hardware, indoor television antennas, fireplace equipment and grilles.

★ ★ ★

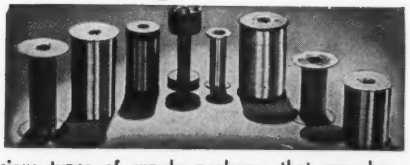
STANDARD UNI-DRIVE WIRE WINDER

INCREASE YOUR PRODUCTION
WITH THIS WINDER

Wire Winder



Pay-off Attachment



Various types of supply packages that may be wound on Standard Uni-Drive Wire Winder.

PAYOFF

Our payoff attachment is made with self-aligning ball bearings and a compensating attachment to control the tension of each end. Applies same tension when spool is empty as when full.

The new Uni-Drive Winder with Payoff Attachment is new in design and incorporates several improved and tested features. Production is stepped up through increased speed. It produces smooth, even and accurately wound spools of wire in single or multiple ends. All strands parallel—no over or under-winding. Automatic Stop-Motion controls each strand. Compensating attachment produces perfectly controlled tension. Traverse adjustable from 1¾″ to 5½″ between spool heads without changing cam. Designed especially for winding wire to be braided and shielded for electrical conductors up to ¾″ diameter.

Payoff can be equipped with Carboloy Guide Inserts at additional cost.

STANDARD MILL SUPPLY COMPANY
PAWTUCKET, RHODE ISLAND, U.S.A.
1064-1080 Main St.
PAwtucket 3-1534 — 3-1535 — 3-1536

Both materials are produced by the improved Kenmore process. National-Standard acquired rights to the process in 1955 and has concentrated extensive research, development and production facilities to achieve volume production. A technical service division has been established to assist customers in product development.

Webb Wire Marks Golden Anniversary

The Webb Wire Division of **The Carpenter Steel Co.,** marked its fiftieth year in the manufacture of music wire, needle wire and stainless steel spring wire by surpassing all previous tonnage records. The month of March was the best in the company's 50-year history, according to **William A. Millard,** Sales Manager of the New Brunswick, N. J., firm.

★ ★ ★

Started March 20, 1906 by the late **Ernest H. Webb,** the firm was acquired as a subsidiary by The Carpenter Steel Co., Reading, Pa., in 1951.

Sheffield's **KONE-PAK** (patent applied for) is a stout cone-shaped steel frame on which we spool the wire. The whole deal is mounted on a disposable wooden pallet. Packaged in a super-strength cardboard container if desired.

Sheffield Wire in New KONE-PAK can cut your production costs 3 ways!

SHEFFIELD
Manufacturers' Wire

You know your costs on unloading a car containing 100 to 2000 coils of wire. Compare that to picking up and moving 50 compact KONE-PAKS on a pallet handling truck.

Here's other ways you save with KONE-PAKS:
(1) Fewer units stored in more compact space;
(2) faster set-up for threading into machines;
(3) bigger "feedings" for machines; fewer loadings and less dead time.

Of course the best packaging plays second fiddle to what's inside. In this case it's the best wire of its kind—quality-controlled every step of the way from Sheffield furnaces to finished product. Watch your production costs shrink with Sheffield Wire—now with the big plus of KONE-PAKaging.

Products of
SHEFFIELD STEEL
DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

New Marking Machine for Electric Wire and Cable Introduced

A new marking machine of improved design has been developed by **The Gem Gravure Company,** West Hanover, Mass., according to **Joseph C. Gemelli,** President, who established the business after 10 years with the Simplex Wire and Cable Co. as a Methods Engineer.

★ ★ ★

The company is manufacturing wire marking machines, embossing machines, marking and embossing wheels and special inks, specifically formulated for polyethylene, vinyl compounds, Teflon and other synthetic coating materials. These inks have been given Underwriters approval for T and TW wire. Another feature of the inks is that markers may be placed close to the extruder or vulcanizer, which saves space, and will operate at any speed.

★ ★ ★

Because of a new method of manufacture the wheels are reported to give 5 to 8 years of service under normal operation.

★ ★ ★

Full details will be supplied by the company upon request.

New Hook-Up Wires Announced by Revere Corporation

"Permacode" hook-up wires, combining high temperature operating characteristics with permanent and positive identification, are now being manufactured by **Revere Corporation of America,** Wallingford, Conn. These new wires, insulated with extruded du Pont Teflon suitable for continuous operation up to 210°C, are available in fifteen solid colors and any combination of two, three or four colors. The insulating material comes in both solid and striped colors and provides inherently permanent coding, a significant advance in striping technique. Permacode wires are available in nominal .010″ or .015″ wall thicknesses, and are constructed to meet requirements of Military Specification MIL-W-16878/A, types E and EE.

New Precision Spring Tester Permits High-Speed Tests

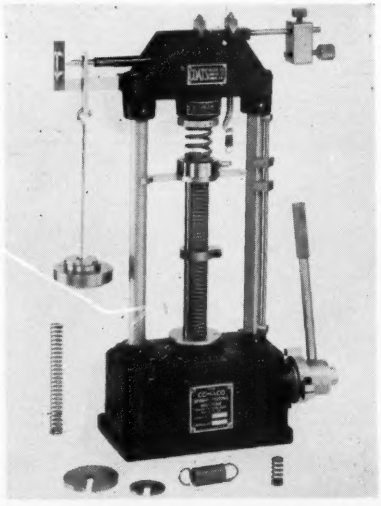
Loads and deflections of compression and extension springs can be tested with extreme accuracy on this new precision instrument. It is used for both general purpose and high quantity production testing at speeds up to 800 tests per hour.

★ ★ ★

The capacity includes loads from ¼ oz. to 200 lbs., spring lengths 0 to 10 in., spring diameters 0 to 2-3/8 in., with a guaranteed accuracy within ¼ of 1% thereby meeting the requirements of the National Bureau of Standards.

★ ★ ★

Automatic production stops and tolerance markers are easily adjustable for rapid production testing. A dial indicator and brackets to read deflections to .001 in. are available for extreme accuracy requirements.



★ ★ ★

The size is 7 in. x 16 in. x 12 in. high, net weight 84 lbs., shipping weight 112 lbs., price $595. FOB N. Y.

★ ★ ★

Bulletin available from **The Carlson Co.,** 277 Broadway, New York 7, N. Y.

Lubrication in Wire Drawing

This book, issued in 1955 by the Technical Committee, consisting of die users and makers of the Council of The British Diamond Die Federation, discusses lubricants for the drawing of copper, aluminum, stainless steel, nickel chromium alloys, steel, tungsten and molybdenum wire.

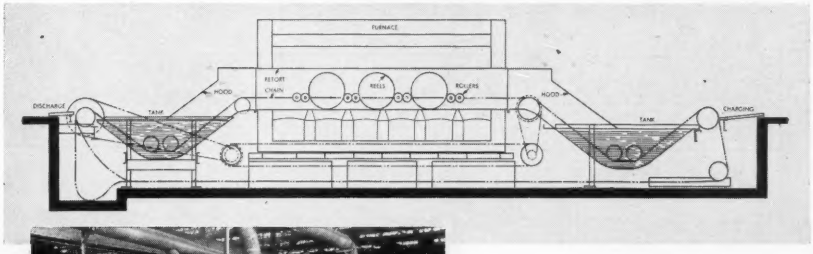
★ ★ ★

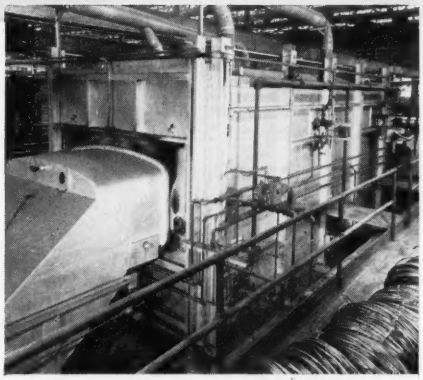
It is primarily a summary of modern practice with respect to drawing these metals through diamond dies. The book does not go into technicalities or scientific details, but is designed for the guidance of the wire drawer, to ensure better quality of wire and better service from the dies.

Cloth bound, 28 pages, the book may be purchased by non-members of the Federation for 10s. 6d. by writing to **The British Diamond Die Federation,** Dickens House, 15 Took's Court, London, E. C. 4, England.

TO SELL—ADVERTISE IN
WIRE AND WIRE PRODUCTS
It pays—send for rates
453 Main St., Stamford, Conn.

Bright Anneals Copper Wire at Lowest Cost





This Rockwell oil fired, continuous furnace anneals copper wire on drums at the rate of 120,000 lbs. per 24 hrs. Drums travel 4 abreast. The work is carried through the exit hood, in foreground, into a steel water tank for quenching, without exposure.

The "wet" method of annealing copper wire (to be subsequently rubber covered), is a Rockwell development that has proved very efficient in operational simplicity, production quality, and labor and space saving.

Drums of coiled wire move continuously, from the wash or other process through a wet or dry seal, then through the alloy retort of the furnace, exit hood, water quench and discharge.

The reels or drums of wire travel several abreast, being rolled along the tanks and retort floor by pipe rollers attached to the alloy link chain conveyor. Length of processing system depends on production needs.

The furnace may be gas or oil fired, or electric. Annealing atmosphere may be provided to assure desired brightness of metal.

It will pay you to learn more about this and other types of Rockwell wire heating equipment. Get Bulletin 432.

ROCKWELL ALSO BUILDS
Batch and continuous furnaces and ovens for annealing, aging, drying, enameling, tinning, glass coating, synthetic coating. Atmosphere generators.

ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY
FURNACES • OVENS • BURNERS • VALVES • SPECIAL MACHINERY
2426 ELIOT STREET • FAIRFIELD, CONN.
Sales Representatives in Principal Cities

AMERICAN IRON AND STEEL INSTITUTE

350 FIFTH AVENUE, NEW YORK 1, N. Y.

AIS 10

Total Number of Companies Included 131

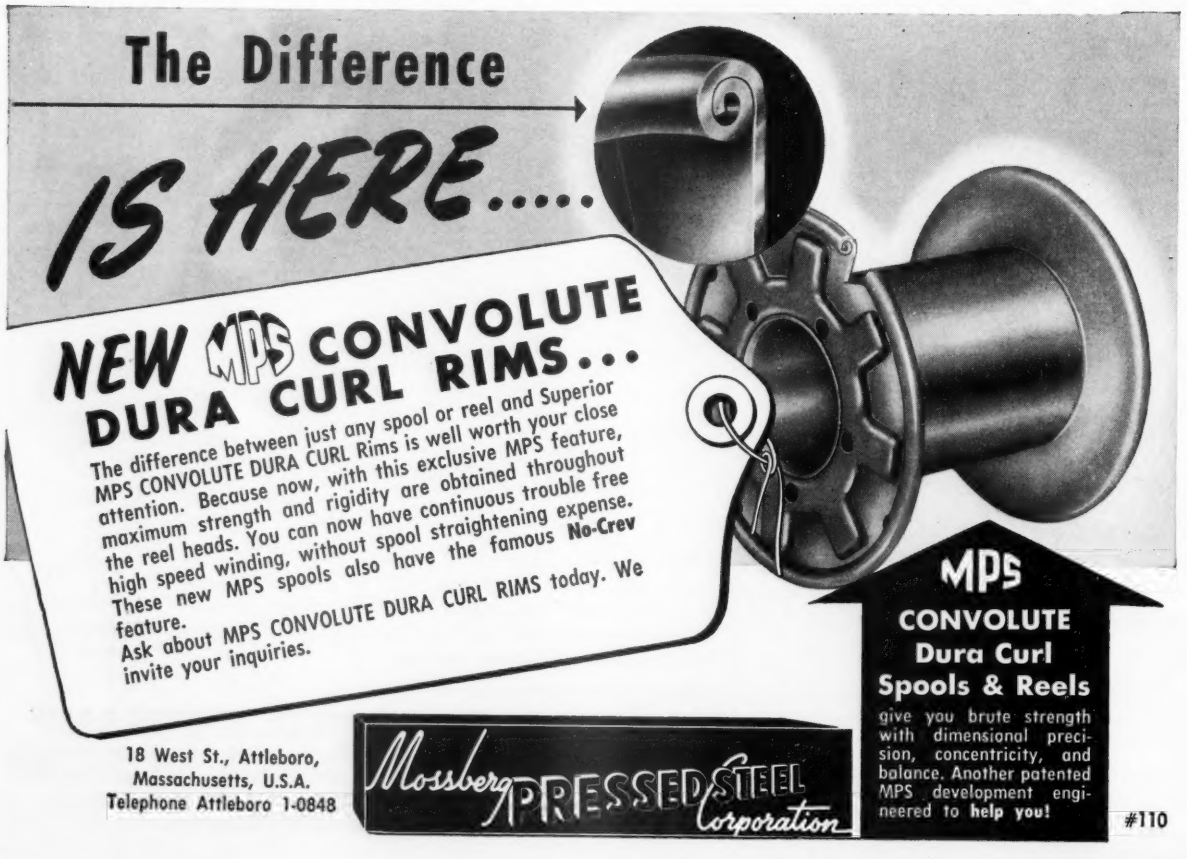
MARCH - 1956
Month

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(Net Tons)

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

Steel Products	Items	CURRENT MONTH 1956 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1955) Percent of Total Shipments	YEAR TO DATE 1956 Carbon	Alloy	Stainless	Total	Percent of Total Shipments	Prior Year (1955) Percent of Total Shipments
Ingots and Steel Castings	1A	73,673	15,504	2,865	92,042	1.1	0.7	187,866	* 45,795	* 7,144	* 240,805	1.0	0.6
Blooms, slabs, billets, sheet bars	1B	166,714	58,284	2,507	227,505	2.8	3.6	509,848	* 163,589	* 6,911	* 680,348	2.9	3.4
Tube rounds	1C	324	51	25	400	-	-	* 541	* 644	57	* 1,242	-	-
Skelp	2	17,514	-	-	17,514	0.2	0.2	43,721	-	-	43,721	0.2	0.1
Wire rods	3	106,589	2,638	541	109,568	1.3	1.4	301,209	7,102	1,346	309,657	1.3	1.4
TOTAL SEMI-FINISHED		364,614	76,477	5,938	447,029	5.4	5.9	* 1,043,185	* 217,130	15,458	* 1,275,773	5.4	5.5
Bars—Hot rolled (incl. light shapes)	14	674,126	197,358	5,723	877,207	10.6	10.5	1,891,519	596,945	15,207	2,503,671	10.7	10.4
Bars—Reinforcing	15	217,321	-	-	217,321	2.6	2.2	573,360	-	-	573,360	2.5	2.1
Bars—Cold finished	16	143,276	29,219	5,481	177,976	2.2	2.3	421,710	89,623	15,802	527,135	2.3	2.3
Tool steel	17	1,560	9,810	-	11,370	0.1	0.1	4,591	28,505	-	33,096	0.1	0.1
TOTAL BARS AND TOOL STEEL		1,036,283	236,387	11,204	1,283,874	15.5	15.1	2,891,180	715,073	31,009	3,637,262	15.6	14.9
Standard pipe	18	271,605	17	1	271,623	3.3	3.3	* 745,707	* 109	1	* 745,817	3.2	3.3
Oil country goods	19	207,647	47,992	-	255,639	3.1	2.7	* 595,120	* 137,539	-	* 732,659	3.1	2.9
Line pipe	20	299,194	-	-	299,194	3.6	3.5	860,520	-	-	860,520	3.7	2.6
Mechanical tubing	21	63,057	27,738	387	91,182	1.1	1.1	189,473	82,593	1,088	273,154	1.2	1.1
Pressure tubing	22	27,569	4,721	2,014	34,304	0.4	0.3	* 73,004	13,267	5,014	* 91,285	0.4	0.3
TOTAL PIPE AND TUBING		869,072	80,468	2,402	951,942	11.5	10.9	* 2,463,824	* 233,508	6,103	* 2,703,435	11.6	10.2
Wire—Drawn	23	281,913	5,194	3,231	290,338	3.5	3.7	807,399	14,276	9,415	831,090	3.6	3.7
Wire—Nails & staples	24	55,786	-	-	55,786	0.7	0.8	154,474	-	-	154,474	0.7	0.8
Wire—Barbed & twisted	25	11,029	-	1	11,030	0.1	0.3	28,100	-	1	28,101	0.1	0.2
Wire—Woven wire fence	26	32,591	-	-	32,591	0.4	0.6	87,015	-	-	87,015	0.4	0.6
Wire—Bale ties	27	5,459	-	-	5,459	0.1	0.1	11,812	-	-	11,812	-	-
TOTAL WIRE & WIRE PRODUCTS		386,778	5,194	3,232	395,204	4.8	5.5	1,088,800	14,276	9,416	1,112,492	4.8	5.3
Black plate	28	86,959	-	-	86,959	1.1	0.9	228,965	-	-	228,965	1.0	0.9
Tin & terne plate—hot dipped	29	113,257	-	-	113,257	1.4	1.3	272,168	-	-	272,168	1.2	1.4
Tin plate—Electrolytic	30	598,129	-	-	598,129	7.2	5.8	* 1,404,984	-	-	* 1,404,984	6.0	5.7
TOTAL SHIPMENTS (1956)		7,620,710	576,826	58,288	8,255,824	100.0	xxx	*21,460,842	*1,667,796	178,635	* 23,307,273	100.0	xxx
TOTAL — PRIOR YEAR (1955)		6,750,842	459,531	58,422	7,268,795	xxx	100.0	17,986,668	1,256,280	155,367	19,398,315	xxx	100.0

* Revised.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COPPER IN FEBRUARY 1956

Refined copper produced at primary plants in the United States, 1954–55 (monthly averages) and 1956, by months, in short tons

	From primary material			From scrap		
	Domestic	Foreign	Total	New	Old	Total
1954	70,143	30,850	100,993	8,518	6,477	14,995
1955	83,125	28,747	111,872	1/6,108	1/11,105	17,213
1956:						
January	93,252	24,379	117,631	6,360	6,466	12,826
February	90,081	30,845	120,926	9,902	11,688	21,590

1/ Revised figures.

Refined copper produced in the United States from scrap, 1954–55. (monthly averages) and 1956, by months, in short tons

	Primary plants	Secondary plants	Total
1954	14,995	2,170	17,165
1955	17,213	2,838	20,051
1956:			
January	12,826	2,892	15,718
February	21,590	2,383	23,973

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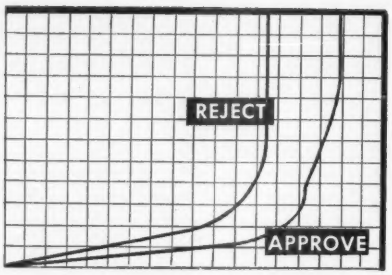

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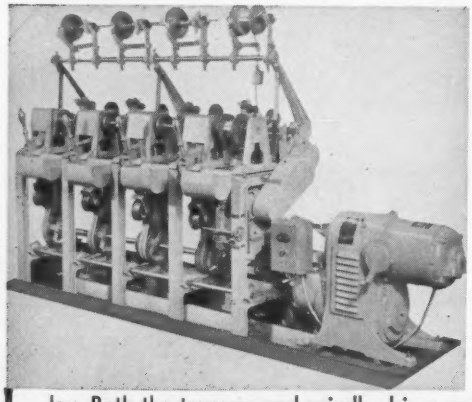

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Capacity: usually 4 to 8 spindles.

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Your special requirements can be incorporated into the design. Each machine is delivered ready for operation from your power supply. Payoff stands furnished as extras.

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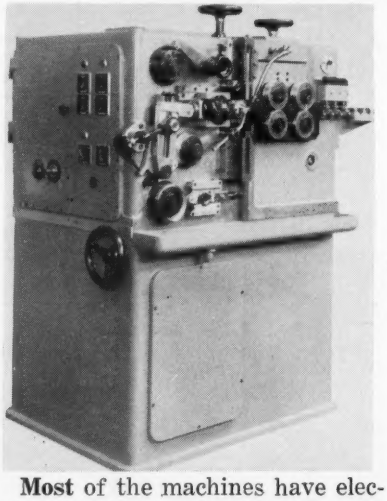
Line of Spring Coilers Announced

A line of Automatic Spring Coiling Machines has been announced by **Emil Schenker AG** of Switzerland. These machines are particularly versatile, embody several new features and are built to the traditionally high standards of Swiss workmanship. The line will handle stock from .005" diameter up to .480" diameter.

★ ★ ★

All models have wire feed drives that can be pre-set to the exact length of the wire required. Most models have a positive, infinitely variable feed drive that is independent of friction and transmits power without slip. The length of wire can be changed instantly, even while operating under full load. One actually "dials" it.



Most of the machines have electric solenoid operated controls that assure minimum set-up time and make it possible to duplicate settings for repeat orders exactly and much quicker than on conventional spring coilers. A special positive control is provided for obtaining an unusually high initial tension of the spring when this is called for by the specification.

★ ★ ★

These machines, it is stated, are available for quick delivery and at prices which are well in line with comparable domestic products.

★ ★ ★

The Schenker line of Spring Coilers is sold in the United States by **George Alexander Zaharoff,** Industrial Consultant, 385 Fifth Avenue, New York 16, N. Y., who will furnish details upon request.

Developments in Submarine Communication Cables

(*Continued from page 677*)

line communication was the unattended repeater. It was found that with increasing dependability of vacuum tubes and with other circuit developments, frequent attention was not required and the equipment could be housed in a small building, or even in a manhole, and visited only occasionally for servicing. This method was a natural for submarine cables from the transmission standpoint because of the constant transmission characteristics and favorable noise conditions.

★ ★ ★

Where a string of islands is available, as in the Missile Test Center off Florida, these repeaters can be on land — the unattended stations being supplied with power transmitted over the cable from the nearest attended station. The separation between repeaters will depend upon the number of circuits required. With repeaters spaced on the order of 70 miles along the cable as many as 12 two-way telephone circuits can be obtained.

★ ★ ★

Usually dry land is not where it is needed and a substitute has to be found. Small floating platforms or buoys offer serious maintenance problems and the simplest solution appears to be to put the repeaters on the ocean bottom. Important questions of detail immediately arise. What requirements must the repeater structure meet? How about routine testing and servicing? What method of operation should the repeaters be designed for? One requirement on the repeater structure is, of course, that it shall not be damaged by the hydrostatic pressure at the ocean bottom, amounting to several thousand pounds per square inch. This is achieved in most cases by enclosing the electrical circuit elements of the repeater in one or more pressure resistant containers. This may call for considerable thickness and weight of steel.

★ ★ ★

Another important requirement on the repeater is that in the laying of it there shall be a minimum

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of interference with the smooth laying cycle. This was briefly touched on earlier and a few more words may be in order. The cable on its way from the ship to the ocean bottom falls at the rate of about 1 nautical mile per hour so that in laying at a speed of 5 knots in water 2 nautical miles deep, the cable will hit the bottom about 10 nautical miles behind the ship. The rather considerable tension on the cable just leaving the ship causes the armor wires to unlay and the cable to untwist, and since the ends of the suspended length cannot rotate appreciably, the untwist at the ship must be compensated by twist-up in the cable close to the bottom, where there is little tension. Since this portion of the cable had been untwisted as it was leaving the ship, the net result in a uniform laying operation is that the cable on the ocean bottom has about the same lay of armor and condition of twist as it had before it left the ship. If this cycle of operations is interfered with, say by interposing at some point of the suspended cable an obstacle to free rotation of the cable in the water, the untwists will not be transmitted past this point, the cable between the obstacle and the bottom will remain untwisted, while between the obstacle and the ship, the cable will be twisted up. Both conditions are conducive to kinks resulting in mechanical faults, and to permanent distortion of the electrical circuit under the armor. Similar effects can take place, even in the absence of any such obstacle to rotation, during a change in ship's speed. The repeater should therefore be of a design that will not impede rotation of the cable and will not require the ship to be stopped in order to get it overboard. These requirements obviously are of lesser importance in shallow water operations, although stoppage of the ship is undesirable in that case also due to the difficulty in holding a ship in a steady position. Possible damage may be done the cable if it is dragged over the ocean floor.

★ ★ ★

The question of testing and servicing the repeater is an important one. Even under good weather con-

ditions lifting a repeater would be an expensive operation and would involve disturbing the cable from a good safe position on the ocean bottom, which is undesirable. The obvious answer to the question is therefore to design the repeaters so that they can be tested from the cable terminals on land and employ long life circuit elements so that they will not need replacement over a long period of time. These principles have been incorporated in the design of all the repeaters that have been successfully laid. The circuit elements are made with unusual care in selection and processing of material, so as to avoid imperfections, and are checked by well-established life tests. Each repeater contains elements that will enable it to respond to maintenance tests at the terminals with a signal that will indicate the condition of its most vulnerable circuit elements — the vacuum tubes.

★ ★ ★

The question of method of operation has been left for consideration until the last, although in most lines of communication it is brought up first. The reason for ignoring it in this manner is that it is first necessary to make sure that all mechanical requirements on the repeater design are satisfied before the nature of the space available for the circuit can be determined. Successful laying of the repeater is, of course, of primary importance. The space available will naturally be small and, therefore, the small circuit elements involved in carrier frequency operation in the kilocycle range are well adapted to it. Other considerations, such as desirable minimum spacing between repeaters, may set limits on the top frequency to be used. A more difficult question to answer is whether the repeaters shall be two directional, permitting two-way conversations on a single cable, or unidirectional, in which case two cables are required for two-way transmission. The answer can be given in part by examining the space available. In the Key West-Havana repeatered cable and in the Transatlantic cable, the repeater was designed to be flexible

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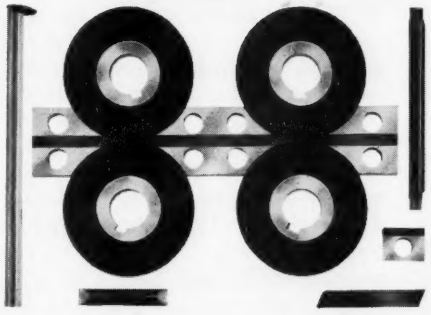

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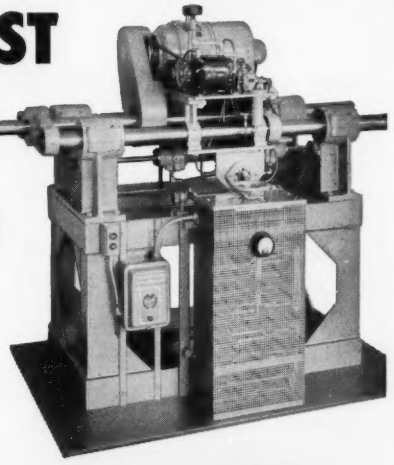

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and small, resembling a length of cable in size and mechanical properties, and it could be laid like a length of cable, passing around the drum and sheaves of the laying gear without any prolonged reduction in the speed of the ship. This met the previously discussed mechanical requirements to a very satisfactory degree. In arriving at this mechanical design, due consideration was given to the wishes of the circuit designer. He was allowed a space in the form of a cylinder 1½" in diameter and as long as he needed, although he was warned that any circuit over 7' long would call for a special explanation.

★ ★ ★

Confinement to a space of this shape is naturally a handicap in circuit layout, and for this reason alone unidirectional operation appeared to be the proper thing. In Great Britain repeaters giving two-way operation have been in successful operation for some years. The repeater in this case is comparatively roomy — a foot in diameter and nine feet long. It is obvious that a structure of this sort, weighing upwards of 1,000 pounds, might have a difficult time satisfying the mechanical requirements for deep water laying. These requirements, of course, may be too severe. Repeaters of the same order of bulk and weight have been laid successfully in water one mile deep, in connection with speeding up the operation of existing telegraph cables. These, however, were single shot operations, and were found to be quite difficult. A continuing operation involving 50 repeaters in a cable would be even more difficult.

★ ★ ★

It might appear that the use of the submerged repeater has seriously weakened the conservative basis of proven integrity to which the cable industry largely owes its existence today. This is not exactly the case. The repeaters in the projects, both telephone and telegraph, have been under study and subject to laying trials over a considerable period of years. According to the 20 year requirement of the unnamed British cable expert earlier referred to, they are almost in.

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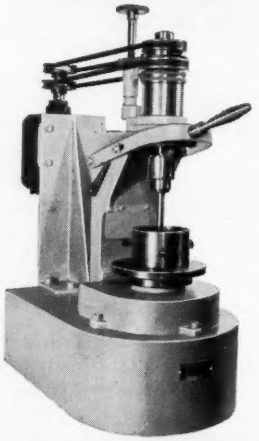

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This also applies to the improved insulating materials that have been introduced during the last 25 years. The first of these was paragutta, a mixture of deresinated balata, deproteinized rubber, and wax. Paragutta was used in the 1930 Key West - Havana carrier frequency cable and in other installations around the world. This material justified all expectations, including constancy of dielectric characteristics with time. A considerable mileage of rubber insulated cable laid during the war has also proven satisfactory. The introduction of polyethylene represented a great advance. In the first place it was a synthetic product, free of the variations and contaminations to which natural products such as gutta percha, balata and rubber are subject. It eliminated the need of purifying processes which do not properly belong in a cable factory. Its one apparent weakness, difficulty of jointing, presented a very serious problem. A solution was found, however, a pressure molding operation, by means of which a perfect blend was obtained between two polyethylene surfaces to be joined. This appeared sufficient to justify the use of the material in actual cables. However, other troubles developed, as experience with the material broadened. One of these troubles arose from the fact that polyethylene is tougher than gutta percha and other insulating materials and tended to take control over the cable core when the latter is recovering from the elongation experienced in laying. The copper conductor in some cases was forced through the wall of insulation, causing a fault. Another trouble is that in certain environments polyethylene is subject to cracking under strain. These two troubles were, fortunately, not widespread in occurrence and preventive measures have been found adequate. The experience does confirm the principle that innovations should be made slowly and with adequate trials.

★ ★ ★

There are other cable developments which are being tried out and which are still subject to the glassy eye of suspicion although

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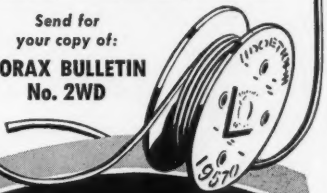

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they look very good. One such is the non-armored cable laid by Western Union a few years ago. Should this prove entirely satisfactory it should be a great boon to cable telegraphy. Elimination of armor wires should help transmission, especially in the higher range of telegraph frequencies.

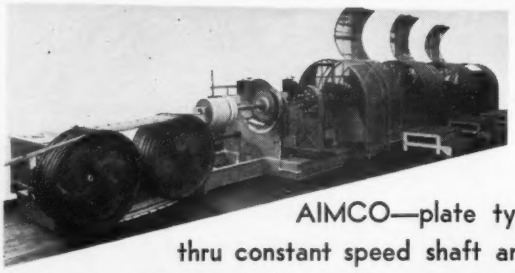
★ ★ ★

The submerged repeater has forced the introduction into cable manufacture innovations which, however, cannot be looked upon as violating the proven integrity principle. One is important in jointing methods. This was one place where resistance to change led to perpetuation of weaknesses. It is not long since the use of more than a few hundred volts on a cable was avoided for fear of breaking down joints. For activating the repeatered cable, thousands of volts must be impressed at the cable terminals. Fortunately a thorough study of jointing had led to a molecular weld which results in continuity of insulation where the surfaces are joined rather than a tight fit which might allow water to penetrate in time. The requirement of meeting very closely the predetermined and uniform parameters of cables for long repeatered systems has called for improvements in manufacture to an unprecedented degree. These changes also should satisfy the demands of proven integrity since the resulting cable is also more uniform mechanically and should have improved laying characteristics.

★ ★ ★

During the above described progress in the cable art, radio, of course, has not stood still. New developments in this field may again cause a shadow to be cast on the submarine cable and may give rise to radical attempts to escape from this shadow. In furthering such attempts it is well to remember that dependability is the characteristic that has kept the cable art alive and the principle of proven integrity must continue to be followed.

4-WIRE TWISTING MACHINES



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It pays—send for rates
453 Main St., Stamford, Conn.

Stainless Steel Wiredrawing Through Diamond Dies

(*Continued from page* 670)

Diamond Die Lubrication.

Water soluble drawing lubricants are commonly employed in multiple drawing machines using diamond dies; these are compounds of soaps and waxes, mixed in warm water at a dilution between 5 to 1 and 8 to 1.

★ ★ ★

One of the worst features in the use of soluble drawing lubricants is their comparatively short life. This is due to the proneness of the oils, fats, soaps or waxes to separate from the water, caused partly by the formation of metallic soaps which are induced by residual coating materials.

★ ★ ★

The modern method of pumping lubricant from the drawing machine circulating tank into the drawing reservoir has the disadvantage of churning oxygen into the fluid.

★ ★ ★

A well mixed emulsion will give excellent cooling and moderate lubrication values for about five days, after which the lubrication value falls off and accelerated rate of cone and die wear may take place. An examination of the metal content of a cleaned tank will determine the metal origin.

★ ★ ★

To test the possibility of die wear being associated with particle diamond to graphite transformation under conditions associated with the high local temperature, straight mineral oils were tried as drawing lubricants. Although good die lubrication properties were anticipated, it was thought that the poor cooling rate may cause the die to show the effect of heating.

★ ★ ★

A "Swift H" general purpose oil was used; the oil temperature rose rapidly at first and then flattened off at 90 deg. F. Although the diamond dies were running at a much higher temperature than hitherto, judging by the heat of the die cases, it is probable that the actual local temperature in the die reduc-

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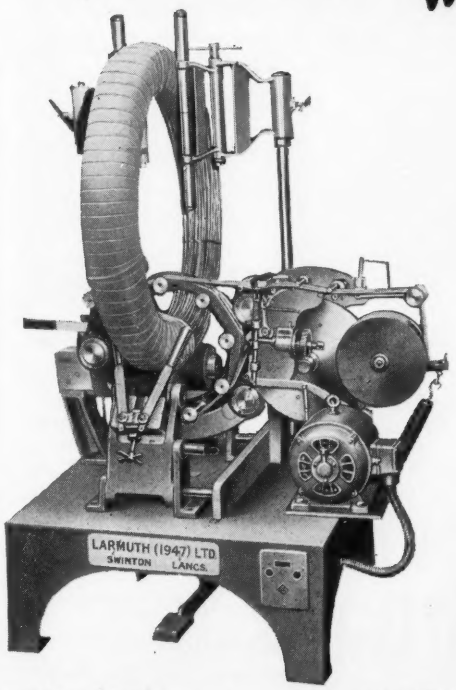

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The DANFORTH PROCESS of reclaiming produces powders that are *guaranteed* to be 99% or better pure.

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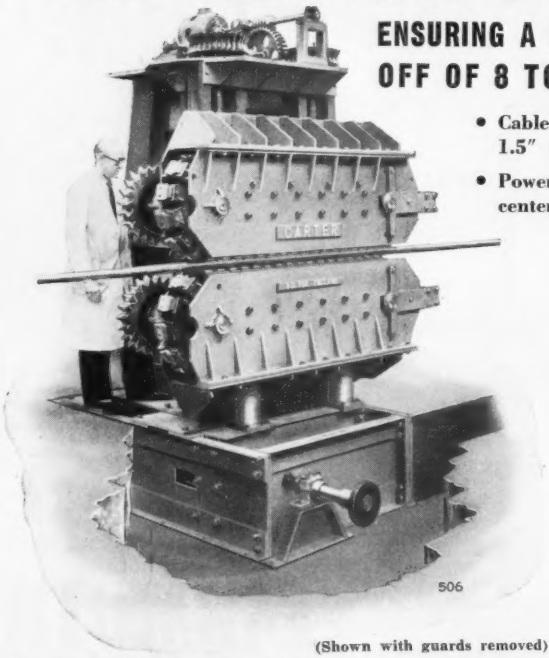

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- **Cable & Wire-Rope from 1.5″ to 3.5″ diameter.**
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tion zones was not above normal. Because it has doubled the die life previously attained by emulsions this oil has now been put into general use; in addition, the efficiency of the oil has been found to be still high when removed at the end of three months' working.

★ ★ ★

To overcome the difficulty previously outlined with regard to high die wear rate when drawing fully softened stainless wire, it is a practise in many shops to give the material one reduction as it is coiled from the annealing furnace. This can be done very successfully with carbide dies if chlorinated paraffin wax is used, but patent rights on this matter should first be studied.

★ ★ ★

Another method involves the use of a hot dip in bees wax, or bees wax and trichlorethylene. This single pass puts the material into a better condition for subsequent multiple diamond die drawing.

★ ★ ★

It may be of interest to note that it has been found profitable to work at the higher end of the hardness range for all cold worked metals when using diamond dies.

★ ★ ★

To draw 140 tons tensile wire at .028 may risk its breakage only because of the pounds pull factor as previously mentioned. The die wear is much worse at the softer end, and decreases as the tensile increases.

★ ★ ★

The most careful consideration must be given to the application of drawing stress to diamond dies —the life of many diamond dies is shortened by threading up. Die life can be considerably increased, and production costs cut, by the use of a good butt welder in the avoidance of the need for frequent re-threading.

Have You Read
"STEEL WIRE
IN AMERICA"?
by Kenneth B. Lewis
The price is $15.00

(*Continued from page 673*)

discuss the quality of steel billets being purchased from **Carnegie Steel Co.** In an address before this very organization later he said he would be met at the Station by Mr. Moen, when there had been a complaint about the quality, and they would stop at the Worcester Club before going to the plant. Mr. Schwab said he never got any farther and he agreed to what Mr. Moen wanted.

★ ★ ★

Among my early recollections, indicating the changed conditions from that day, was the purchase of some steel billets at 13.60 dollars per ton and copper ingots at 8.9 cents a pound. Luckily for me, I guessed right.

★ ★ ★

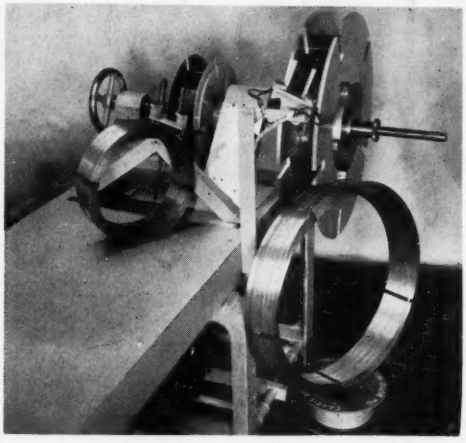
Charles Ranlet became Works Manager when the American Steel & Wire took over. I was his assistant. His untimely death at 42 jumped me into his place. I occupied that post until I became President of the **Trenton Iron Co.,** Trenton, N. J., which was founded only a few years later than Ichabod Washburn's company, by the famous **Peter Cooper** and **Abraham S. Hewitt,** the latter Mayor of New York at one time, now the Trenton Works of American Steel & Wire.

★ ★ ★

One of my interesting personal experiences I will relate because I think it points to the man who deserves untold credit in his advocacy of business principles, which are so well understood today. I had a business appointment in New York with Vice President **Dickson** of the Steel Corp., and a wonderful character he was! We finished about noon and he said, "Won't you stay and have lunch with me?" I said, "I would be glad to." Lo and behold, he took me into the private dining room of the Steel Corporation officials. As you can imagine, I was all agog to see these men of national reputations. **Judge Gary,** the Chairman, was there and when we had finished eating, I noticed they all settled

NEW . . .

THE BOYD MICRO-SPOOLER & COILER



The Boyd MICRO-SPOOLER has been an astounding success in perfect level layer winding of Aluminum, Bronze Stainless Steel and all other types of welding wire on disposable spools. With adaptors it can now wind the same wire in self contained coils in perfect level layer wind as on the spools.

Send us a sample of your welding wire in sizes down to 1/32". We will wind it on your spools or ours. Better still have your engineers visit our plant and see a demonstration.

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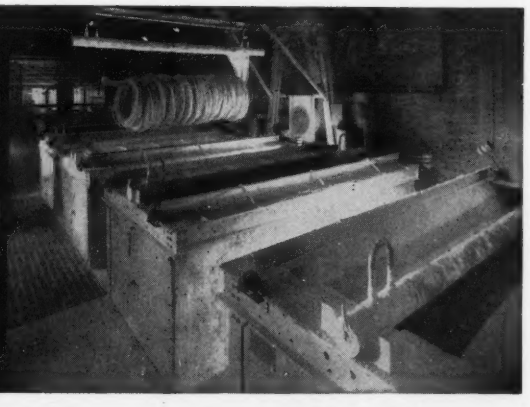

Faster baking, greater fuel economy, maximum production efficiency are just a few of the results of the exclusive heating arrangement of the Carl Mayer Hi-Speed Rod Baker. It also has a patented blow-off feature which removes moisture without damage to coils.

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Write for Bulletin No. 350

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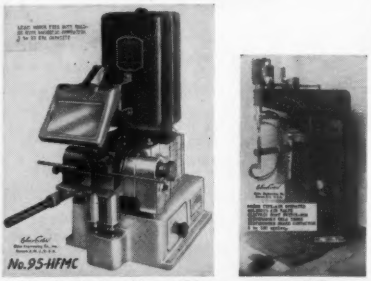
THE WIRE INDUSTRY
A WELDER FOR EVERY PURPOSE



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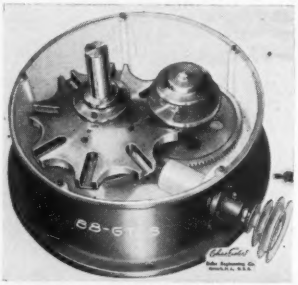

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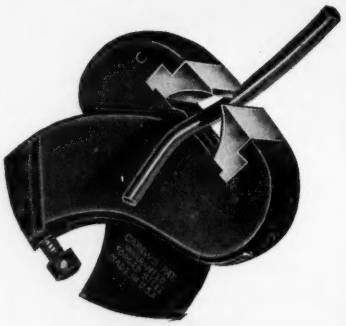

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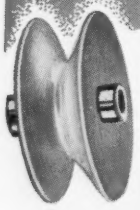

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back in their chairs and Judge Gary said, "Gentlemen, how many commandments are there?" Someone quickly said, "Ten." The Judge remained silent, and someone else said, "Eleven." The Judge said, "Right." Which shows you should not answer a question unless you can go further. "What is the eleventh commandment?" My friend said, "A new commandment give I unto ye; that you love one another." The Judge, using this as a text, delivered a talk on responsibilities that industry had, not only to the stockholders but to labor, customers, competitors and the public.

★ ★ ★

Not long afterwards came the abolishment of the 12 hour day and the publication of basic steel price structures that all could understand and that were fair to all. As we remember, some of these things were not popular at the time and thought to be impracticable. The years since have justified their wisdom. In these days we hear a great deal of criticism about the use of power by great companies.

★ ★ ★

It is interesting to note that these criticisms are not applied to the U. S. Steel Corp. The standards outlined by Judge Gary have been carried on by his successors and we have seen the results. One of Judge Gary's speeches had the following sentence, which I like to quote: "The badge of greatness is not the power to command, but the acceptance of the obligation to serve."

★ ★ ★

Irving Olds, a former Chairman of the Corporation, and a gentleman whose friendship I valued greatly, put it in these words: "All of us can take just pride in the life and accomplishments of Judge Gary." We are deeply grateful to him for his mighty contributions towards the future security and prosperity of American industry.

★ ★ ★

Looking back, we marvel at some of the things we dared to do in our early days. The records of the **American Iron & Steel In-**

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stitute of the annual dinner May 25, 1917, refer to me as a speaker. Judge Gary presided. In those days he called on two or three to speak in addition to the listed orators. Just to show that times do not change, I take the liberty of quoting a few lines of my remarks: "I have been wondering why I was asked to be on this program. I think perhaps the Committee thought they had to have one lone customer come along with the great list of steel producers. We were a very popular class of people a few years ago. You sent us cigars, you invited us to dinners, you broached to us the wonderful story of the quality of your product. Today we are left alone and desolate. We hunt you up; we find the doors closed and a sign on them, 'Out until 1918'." To that jovial remark I added what I could say today, "We are willing to put our interests in your hands based on the way you have treated us in the past." Then I concluded with the story I have related about my first meeting with Judge Gary.

* * *

During my business life it has been my great good fortune to have had contacts and close friendship with many of the leaders of the Steel Corporation:—**Irwin, Farrell, Olds, Fairless** and, of course, with our guest of honor tonight, **Clifford Hood.** All of these men were worthy of their high positions, as is the case of the present Chairman of the U. S. Steel Corporation, **Roger Blough,** who has honored us by his presence tonight.

* * *

My reminiscences of acquaintance and friendship with **Mr. Farrell** are particularly pleasing. His entry into the wire business was in the wire mill at New Haven. His father was a sea captain. Word was received of his loss at sea and young Farrell left home, his mother supposing he was going to school. Instead he got a job in the wire mill and from that start he went up to the top. Perhaps the contribution which led to the high position he attained was his development of the export business under what was known as the

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Available in two sizes:
1B cuts wire and cable up to 3/8" diameter.
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Send us sample of metal to be cut and we will advise proper type of jaws required. HKP®

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Aluminum—Annealed—Belt Lacing—Brass, Soft and Spring—Copper, Bare and Tinned
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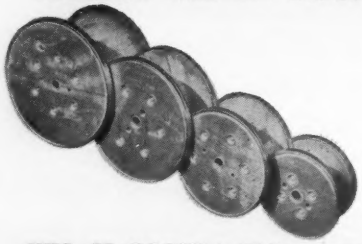

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Especially designed to prevent breaking or splintering.

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U. S. Steel Products Export Co. A most intimate friendship developed between us. I went to him frequently for advice and shall long remember his friendliness in connection with my coming back to Worcester.

★ ★ ★

At a gathering like this, sponsored by the Chamber of Commerce, I think we have a right to do a little boosting for Worcester. We are particularly proud of the record of men who were trained in Worcester and moved upward to responsible positions in the Corporation. I take pleasure in mentioning the following:

J. Lester Perry (deceased) Worcester District Manager 1929-1932, later President of the Tennessee Coal & Iron Co., and President, Carnegie Illinois Steel Corp.

Bertram A. Lawrence (deceased) Chief Draftsman & District Engineer 1913-1922, later Vice President, Engineering, U. S. Steel Corporation.

Clifford F. Hood, Worcester District Manager 1933-1935, now President U. S. Steel Corporation.

Malcolm W. Reed, Assistant Manager Worcester District 1928-1932, now Executive Vice President—Engineering and Raw Materials, U. S. Steel Corporation.

Walter F. Munford, Worcester District Manager 1941-1945, now President, American Steel & Wire Division, U. S. Steel Corporation.

★ ★ ★

I particularly wish to refer to **Lester Perry** because we worked together in the early days. I remember when due to unusual circumstances I became Manager of the Worcester District at an early age. Lester, who was working in the Accounting Department came to me and said he would like to get into the production end. I, of course, said "okay" immediately. His record from that day to his passing was outstanding.

★ ★ ★

This concludes this brief story of some of the historical incidents of the Wire Industry and reminiscenses of the later years with which many of us are familiar.

★ ★ ★

Some time ago I saw an advertisement which showed a silver airplane flying over the Pyramids. The statement read, "Looking down on 5,000 years." Tonight we have been looking back over 125

years. The progress during these years has, of course, gone far beyond the total progress of the 5,000 earlier years.

★ ★ ★

We are truly proud of the part played in this by those who have been in the Iron and Steel business whom we honor tonight. There is a poem entitled "Worcester" written by the late **Frank Roe Batchelder,** which seems to me to reach the heart of this anniversary. I quote the last verse:

"In war, in peace, in school, in shop, Beyond the knowledge of her name, Rising insistent to the top, Those she has bred have brought her fame."

★ ★ ★

To no one is this more applicable tonight than to our guest of honor, **Clifford Hood.**

New Design Manual On Wire Thread Inserts

Engineers in the automotive, aviation, military and general industrial fields designing in aluminum, magnesium, plastics, and wood as well as iron and steel will be interested in the new "Design Manual and Catalogue" (Bulletin 625-A) on wire thread inserts made by the **Heli-Coil Corporation,** Danbury, Conn.

★ ★ ★

The manual presents complete design data with thirteen line drawings, eight photographs and ten multi-page tables.

Physical, Chemical and Electrical Properties of Marlex* Ethylene Polymers

(*Continued from page* 662)

stress-strain properties with these additives.

★ ★ ★

Another indication of the inertness of this new polymer is its resistance to penetration by gases and liquids. The permeability rate of gases such as hydrogen, carbon dioxide, oxygen, water vapor, etc., as determined on thin film, is from 15 to 30 per cent that for high pressure polyethylene, and the permeability to alcohols, ketones, es-

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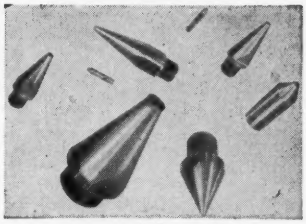

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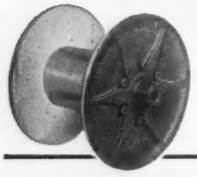
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ters, essential oils, and chlorinated solvents is only about 10 per cent.

★ ★ ★

Of considerable interest to all wire and cable fabricators is the ability of a polymer to resist "environmental stress cracking." Based on the work of De Coste et al. (8), crack resistance of ethylene polymers is related to the molecular weight of the polymer. **Marlex** 50 polymer should show excellent resistance to environmental stress cracking because of its high molecular weight (indicated by melt index); however, other factors such as higher crystallinity have an adverse effect (8). In the case of high pressure polymers, the crystallinity does not vary enough to be the predominant factor in this phenomenon. With the low pressure **Marlex** 50 polymer the effect of crystallinity is much more pronounced. These effects are illustrated in Table IV. It is obvious

TABLE IV
COMPARISON OF ENVIRONMENTAL STRESS CRACKING IN IGEPAL AT 50° C.

Polymer	Melt Index	Density	F_{50} Value (Hours to 50% Failure)
MARLEX 50	0.6	0.96	20
Irradiated MARLEX 50 (10^6 rep.)	-	0.96	>1080
High Molecular Weight MARLEX	<0.1	0.96	1300
MARLEX Copolymers	0.4	0.93	>4000
High Pressure Polyethylene	2.0	0.92	2
High Pressure Polyethylene	0.4	0.92	>4000

from these data that **Marlex** 50 polymer has better resistance to stress cracking than the general purpose polyethylene but is not as resistant as the high molecular weight high pressure resins. By increasing the molecular weight of **Marlex** 50 polymer, a marked increase in stress crack resistance is obtained. High energy radiation also imparts excellent stress cracking resistance to a **Marlex** 50 polymer. But more important, by reducing crystallinity as with the copolymers, one obtains optimum stress crack resistance.

Electrical Properties

Since Marlex 50 is an ethylene polymer and has non-polar and symmetrical structure, its electrical properties are essentially the same as those of conventional polyethylene. One difference is a slightly higher dielectric constant which

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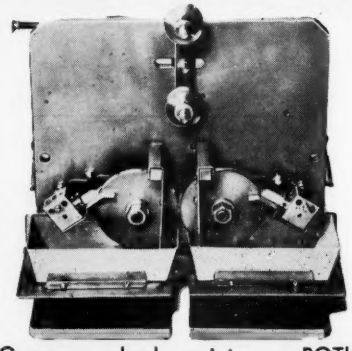

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can be accounted for by its higher density. These properties are listed in Table V.

TABLE V

ELECTRICAL PROPERTIES OF ETHYLENE POLYMERS

	MARLEX 50	High Pressure Polyethylene
Dielectric Constant		
1 Kc	2.34-2.36	2.28-2.32
1 Mc	2.34-2.38	2.28-2.32
30 Mc	2.36	2.29
Dissipation Factor		
1 Kc	0.0002	0.0002
1 Mc	0.0003	0.0003
30 Mc	0.0001	0.0002
Volume Resistivity (ohm-cm)	$>6 \times 10^{15}$	$>6 \times 10^{15}$
Dielectric Strength (V/M, short time)	510	500

Conclusions

For utilization as insulation in the wire and cable industry, it appears that **Marlex** ethylene polymers offer all the advantages of conventional polyethylene and, in addition, have extended the useful range of these thermoplastics in the following:

1. **Increased softening temperature.**
2. **Improved abrasion resistance.**
3. **Extended environmental stress cracking time.**
4. **Decreased permeability to liquids and gases.**

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Note: In Table II, Oleic acid under Marlex 50 should read "0.70" and under High Pressure Polyethylene, "1.57."

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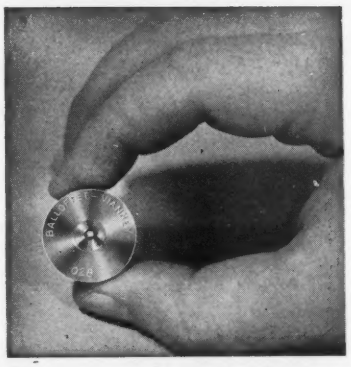

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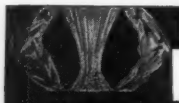
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Modern Rod Baker Trends

(*Continued from page* 659)

coil. For complete scale removal, pickling is done in 10 to 40 minutes depending on the grade of steel and the solution temperature in the tanks of sulphuric acid solution.

★ ★ ★

After pickling, each scale-free "batch" is transferred to a cold water rinse and then to the lime tanks in the line. These tanks, contain 2%, 5%, and 10% suspensions of lime to meet varying coating requirements. Rod coils are immersed in the lime long enough to insure a complete covering, after which they are picked up by the cranes and carried to the rod bakers.

★ ★ ★

In straight line production, bakers are located side by side, in line with the cleaning tanks. While oven designs differ in certain respects, self-opening and closing, counterbalanced doors have found wide acceptance by the wire industry. The weight of the loaded yoke being lowered into the oven forces the doors which are hinged at the side down into the oven. When the yoke has been charged, counterbalance weights automatically force the doors to swing upward and close. The top bar of the yoke is equipped with inverted "U" hooks. During the drying cycle it rests on the top edge of the oven out of the heat zone, thus providing a simplified, easy way of engaging the yoke with the crane after drying has been completed.

★ ★ ★

During unloading, doors are pivoted upward by the emerging coils. When the load has moved clear, the baker doors move back to a closed position. This type of door and hinge design permits rapid charging and discharging with little loss of oven heat.

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Index to Advertisers

A

Acrometal Products, Inc. ... 692
Ajax Industrial Supplies, Inc. ... 720
Allis Company, Louis, The ... 706
Alloy Metal Wire Div., H. K. Porter Co., Inc. ... 683
American Insulating Machinery Company ... 694
American Lanolin Corp. ... 718
American Steel & Wire Div., U. S. Steel Corp. ... 617
American Woodworking Co. ... 721
Angier Corporation ... 687
Apco Mossberg Co. ... 681
Arkell Safety Bag Company ... 721
Arms, Clarence S. ... 722

B

Balloffet-Vianney Wire Die Co., Inc. ... 719
Bethlehem Steel Company ... 620
Bick, Hans C., Inc. ... 708
Boulin, Victor J., Inc. ... 720
Boyd & Sons Mfg. Company ... 713
Brenon, Inc. ... 720
Bridge Mfg. Co. ... 611

C

Camden Wire Co., Inc. ... 688
Carboloy Dept. of General Electric Co. ... 614
Carl Meyer Corp., The ... 713
Carter & Company, Ltd., B. & F. ... 712
Cedar West Tool Co., Inc. ... 619
Chase Brass & Copper Co. ... 641
Cleveland Tramrail Division of The Cleveland Crane & Engineering Co. ... 646
Continental Can Company ... 663
Continental Steel Corporation ... 680
Cook Mfg. Co. ... 690
Coulter & McKenzie Machine Co., Inc., The ... 660
Crafts, Arthur A., Co., Inc. ... 707
Crucible Steel Company of America ... 615

D

Danforth Co., C. W., The ... 712
Davis-Standard Sales Corp. ... 640-B
Drever Company ... 635
Durant Mfg. Co. ... 706
Durkee Mfg. Co., Inc. ... 718
Dykrex Corporation of America—Roos Tool & Mfg. Div. ... 708

E

Eastern Carbide Corp. ... 719
Edmands Company, The ... 710
Eisler Engineering Co., Inc. ... 714
Electric Furnace Company, The ... Back Cover
Electronic Rubber Co. ... 711
Elgin National Watch Co., Abrasives Div. ... 671
Emory, Robert J., Company ... 704
Engis Equipment Co., Hyprez Div. ... 621
Entwistle Manufacturing Corp. ... 648

F

Fenn Manufacturing Co., The ... 679
Firth Sterling, Inc. ... 628
Fisher Associates ... 722
Fort Wayne Diamond Products, Inc. ... 720
Fort Wayne Wire Die, Inc. ... 720

G

Gillies Co., Inc., Duncan M. ... 719
Glader, Wm., Machine Works ... 685

H

Haskell-Dawes Machine Co. ... 705
Heany Industrial Ceramics Corp. ... 714
Hobbs Manufacturing Co. ... 707
Hubbard Spool Company ... 629

I

Indiana Wire Die Company ... 720
Industrial Gauges Corporation ... 616
Industrial Ovens, Inc. ... 674
International Fine Wire Co., Inc. ... 703

J

Jury's Wire Products Inc. ... 720

K

Kellogg Company, M. W., Chemical Mfg. Div. ... 637
Kelly Wire Die Corp. ... 720
Kennametal, Inc. ... 630
Keystone Steel & Wire Co. ... 684

L

Lancaster, Allwine & Rommel ... 722
Larmuth (1947) Ltd. ... 711
Lewis Machine Co., The ... 633
Litzler Co., Inc., C. A. ... 682

Mc

McCaskie, Inc., Wm. ... 716

M

Magnuson Products Corporation ... 710
Main, Robert A. & Sons, Inc. ... 721
Malin & Company, The ... 716
Marvel Industries, Inc. ... 632
Mason Can Company ... 689
Metal Carbides Corporation ... 626
Mettler Machine Tool, Inc. ... 631
Michigan Oven Co. ... 624 and 625
Micro Products Company ... 678
Miller, R. H. Co., Inc. ... 654
Milton Machine Works, Inc. ... 718
Molina-Straus Diamond Products Co. ... 720
Monsanto Chemical Co., Plastics Division ... 642
Montgomery Co., The ... 716
Morgan Construction Company ... Front Cover
Mossberg Press Steel Corp. ... 702
Muncy Valley Industries, Inc. ... 717

N

National Lock Washer Company ... 623
National Machinery Exchange ... 721
National Research Co. ... 715
National Waterproof Papers, Inc. ... 721
National Wire Die Company ... 720
Naugatuck Chemical Division of United States Rubber Company ... 649
Nelson, Co., The ... 721
New England Butt Co. ... 716
New England Wire Die Co. ... 720
Nilson Machine Co., A. H., The ... 696
North Anson Reel Co. ... 643
Norton Company ... 693

P

Pacific Coast Borax Company ... 709
Parkin Chemical Co., The ... 721
Pennsylvania Salt Mfg. Company ... 618
Peschel Electronics, Inc. ... 715
Pittsburgh Carbide Die Co. ... 720
Pittsburgh Plate Glass Co. ... 634
Pittsburgh Steel Company ... 644 and 645
Plandex Corp. ... 709
Platt Brothers & Co., The ... 721
Plymouth Cordage Company ... 697
Porter, H. K., Inc. ... 715
Pourtier, Pere et Fils ... 688

R

Republic Steel Corp., Pressed Steel Div. ... 613
Robinson, M. W., Co., Inc. ... 714
Rockwell Company, W. S. ... 701
Roebling's, John A. Sons, Corp. ... 640-A
Rome Soap Mfg. Co. ... 721
Royle, John & Sons ... 686
Rusch Wire Die Corporation ... 720

S

Scott Testers, Inc. ... 704
Scovill Mfg. Company ... 622
Scudder, E. J. Foundry and Machine Co. ... 721
Sheffield Steel Division, Armco Steel Corporation ... 700
Sjogren Tool and Machine Co., Inc. ... 705
Sleeper & Hartley, Inc. ... 721
Standard Industrial Compounds Co., Inc. ... 609
Standard Mill Supply Co. ... 699
Strand-Buffalo Corp. ... 721
Swift & Company ... 636
Syncro Machine Co. ... 612

T

Terkelsen Machine Company ... 721
Torrington Mfg. Co., The ... 627

U

Union Wire Die Corp. ... 719
U. S. Industrial Chemicals Co., Division of the National Distillers Products Corporation ... 638
U. S. Steel Corporation, American Steel & Wire Div. ... 617
Universal Industrial Equipment Corp. ... 695
Universal Wire Die Co. ... 720

V

Vascoloy-Ramet Corp. ... 652
Vaughn Machinery Co., The ... 639

W

Warner Company ... 714
Waterbury Farrel Foundry & Machine Co. ... 651
Watson Machine Co., The ... Inside Back Cover
Wayne Wire Die Co. ... 720
Wells, Frank L., Co. ... 698
Wickwire Brothers, Inc. ... 717
Wilson, Lee, Engineering Co., Inc. ... Inside Front Cover
Wire Equipment Mfg. Co., Inc. ... 715
Wire & Textile Machinery, Inc. ... 717
Wire Insulating Machinery Inc. ... 691
Wire Tool Div., Bridgeport Jig Boring Co. ... 717

Y

Youngstown Sheet & Tube Co., The ... 610

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United States Industrial Diamond Corp., New York, N. Y.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ADJUSTABLE SPEED DRIVES
The Louis Allis Company, Milwaukee, Wisc.

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

BAKERS—
(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Carter & Co., Ltd., B. & F., Bolton, England.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc (used) Pawtucket. R. I.

BORAX—Wire Drawing
Pacific Coast Borax Co., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CABLE FILLERS—Paper
Plymouth Cordage Company, Plymouth, Mass.

CAPSTANS—for Wire
Litzler, C.A., Co., Inc., Cleveland, Ohio.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Carter & Co., Ltd., B. & F., Bolton, England.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee Engr. Co., Cleveland, Ohio
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

CLOTH—WIRE, All Metals
Baker, James S., (Imports) Co., 311 California St., San Francisco, Calif.
Chase Brass & Copper Co., Waterbury, Conn.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Pennsylvania Salt Mfg. Company, Philadelphia, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago.
Rusch Wire Die Corporation, Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.
Whittaker, Clark & Daniel, Inc., New York, N. Y.

COMPOUNDS—Extrusion, for Wire
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corporation, Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corporation, Brooklyn, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS, Vinyl
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H. Co., Inc., Homer, N. Y.
Pacific Coast Borax Co., New York, N. Y.
Pennsylvania Salt Mfg. Company, Philadelphia, Pa.
Rome Soap Manufacturing Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Carter & Co., Ltd., B. & F., Bolton, England.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.

CUTTING TOOLS—Wire
Porter, H. K. Inc., Somerville, Mass.
Robinson, M. W. Co., Rockfall, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Molina-Straus Diamond Products Co., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
United States Industrial Diamond Corp., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Molina-Straus Diamond Products Co., New York, N. Y.
National Research Company, St. Clair Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.
United States Industrial Diamond Corp., New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Danforth, The C. W. Co., Youngstown, Ohio
Industrial Diamond Powders, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
National Research Co., St. Clair Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.

DIAMOND TOOLS—
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Molina-Straus Diamond Products Co., New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Union Wire Die Corporation, New York, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., New Brunswick, N. J.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N.Y.
Union Wire Die Corporation, New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES DIAMOND—Reversible
National Wire Die Co., New York, N. Y.

DIES—Extrusion
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc, New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die., Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
National Wire Die Co., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Union Wire Die Corporation, New York, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wayne Wire Die Co., Hillside, N. J.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.

DIES—Swaging
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., Waukegan, Ill.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Electric, Adjustable Speed
The Louis Allis Company, Milwaukee, Wisc.

DRUMS—Wire Packaging
Continental Can Company, Van Wert, Ohio

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Co., Garrett, Ind.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

DRYING EQUIPMENT
Carl Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.

ENGINEERS—Consulting
Lubricants—Hans C. Bick, Inc., Reading, Pa.
Wire Mill—Clarence S. Arms, Worcester, Mass.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FREQUENCY CHANGERS
The Louis Allis Company, Milwaukee, Wisc.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Co., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Resistance Heating, Strand
(See Annealing Machines)

FURNACES—Salt Bath
Ajax Electric Co., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.

FURNACES—Strand Annealing
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.

GAUGES—Wire Diameter, Continuous
Industrial Gauges Corporation, West Englewood, N. J.

GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)

GEARMOTORS
The Louis Allis Company, Milwaukee, Wisc.

GRINDERS—Roll
Norton Co., The, Worchester, Mass.

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HARDSURFACING ALLOYS—
(See Alloys—Hardsurfacing)

HOOKS—Pickling & Liming
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Kellogg Company, M. W., Chemical Manufacturing Division, Jersey City, N. J.

INSULATING MATERIALS—
Celanese Corporation of America, New York, N. Y.
Chemical Products Co., E. Providence, R. I.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.
Plymouth Cordage Company, Plymouth, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

INSULATING MATERIALS—Paper (For Electric Wire Cable)
Plymouth Cordage Company, Plymouth, Mass.

LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire

LACQUERS—For Electric Wire
Chemical Products Co., E. Providence, R. I.

LAGGING—Reel
North Anson Reel Co., No. Anson, Me.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., The, Philadelphia and Bellefonte, Pa.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Rome Soap Mfg. Co., Rome, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Bick, Hans C., Inc., Reading, Pa.
Swift & Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Bending Wire
Eisler Engineering Co., Newark, N. J.

MACHINERY—Bobbin Winders
Cedar West Tool Inc., New York, N. Y.
Mummert-Dixon Company, Hanover, Pa.
Wire Equipment Mfg. Co., Trenton, N. J.

MACHINERY—Braiding
Carter & Co., Ltd., B. & F., Bolton, England.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Haskell-Dawes Machine Co Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Chain Making
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Closing Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Coil Wrapping (Paper)
Angier Corporation, Framingham, Mass.

MACHINERY—Copper Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wells, Frank L., Co., Kenosha, Wis.

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.
Herborn, Herborn, Germany.

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Firth Sterling, Inc., Pittsburgh, Pa.
Union Wire Die Corporation, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Oven, Company, Detroit, Mich.
Rockwell Co., W. S., Fairfield, Conn.

MACHINERY—Extruding
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Mettler Machine Tool, Inc., New Haven, Conn.
Rockwell, W. S., Company, Fairfield, Conn.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Oven Company, Detroit, Mich.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Cook Mfg. Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, O.
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Cedar West Tool Inc., New York, N. Y.
Mummert-Dixon Co., Hanover, Pa.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle Manufacturing Corporation, Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.

MACHINERY—Pickling
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Plating
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury Conn.

MACHINERY—Printing on Electric Wire
Gillies, Duncan M. Co., Inc., Boylston, Mass.

MACHINERY—Pumps for Molten Metal
Wire Equipment Mfg. Co., Trenton, N. J.

MACHINERY—Re-Spooling
Boyd & Sons Manufacturing Corporation, Philadelphia, Pa.
Emory, Robert J., Co., Newark, N. J.
International Wire Products Corp., Woodside Machinery Division, Midland Park, N. J.
Mummert-Dixon Co., Hanover, Pa.
National Mach'y Exch. (Used), New York.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.
Wire Insulating Machinery Inc., Northboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Rod Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Sales Corp., Mystic, Conn.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Royle, John & Sons, Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Spark Testing
Entwistle Manufacturing Corporation, Providence, R. I.
Peschel Electronics, Inc., New Rochelle, N. Y.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Nilson, A. H. Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen, Wurtt., Germany

MACHINERY—Straightening & Cutting
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Carter & Co., Ltd., B. & F., Bolton, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
American Insulating Mach'y Co., Phila., Pa.
Davis-Standard Sales Corp., Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Fenn Manufacturing Co., Newington, Conn.
Industrial Ovens, Inc., Cleveland, Ohio
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Pourtier Pere et Fils, Romainville (Seine), France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing Magnet Wire Coatings for Pin Holes
Peschel Electronics, Inc., New Rochelle, N. Y.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Turks Head
Fenn Manufacturing Co., Newington, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Emory, Robert J., Newark, N. J.
Fenn Manufacturing Co., Newington, Conn.
Hobbs Manufacturing Co., Worcester, Mass.
Mummert-Dixon Co., Hanover, Pa.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Equipment Mfg. Co., Trenton, N. J.
Wire Insulating Machinery Inc., Northboro, Mass.

MACHINERY—Wire Drawing
Cook Manufacturing Co., The, Paterson, N. J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Herborn, Herborn, Germany
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Morgan Construction Co., Worcester, Mass.
Morgardshammers Mek Verstads AB, Morgardshammer, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Carter & Co., Ltd., B. & F., Bolton, England.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Larmuth (1947) Ltd., Swinton, England
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MOTORS—Electric, A. C. & D. C.
The Louis Allis Company, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Wire Tool Div., Bridgeport Jig Boring Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Michigan Oven Company, Detroit, Mich.
Rockwell Co., W. S., Fairfield, Conn.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Litzler, C. A., Co., Inc., Cleveland, Ohio.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAPER—Creped Wrapping
Angier Corporation, Framingham, Mass.
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, Framingham, Mass.
Arkell Safety Bag Company, New York, N. Y.
National Waterproof Papers, Inc., Beverly, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—Insulating
Plymouth Cordage Company, Plymouth, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Eng'g Co., Youngstown, Ohio.

PLASTICIZERS—
Celanese Corporation of America, New York, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS COMPOUNDING — Custom
Electronic Rubber Company, Stamford, Conn.
Plandex Corporation, Downingtown, Pa.

PLASTICS—for Wire Insulation
Celanese Corporation of America, New York, N. Y.
duPont de Nemours Co., (Inc.), E. I., Polychemical Dept., Wilmington, Delaware
Electronic Rubber Co., Stamford, Conn.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plandex Corporation, Downingtown, Pa.
U. S. Industrial Chemicals Company, Division of National Distillers Products Corporation, New York, N. Y.

POINTING WIRE
Main, Robert A. & Sons, Inc., Paramus, N. J.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRINTING WHEELS—for Electric Wire
Gillics, Duncan M. Co., Inc. Boylston, Mass.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

PUMPS—Molten Metal
Fisher Associates, New York, N. Y.

REEL AND TENSION STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc.,Minneapolis, Minn.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Garrett, Ind.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Metal Bound
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
North Anson Reel Co., No. Anson, Me.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Nelson Company, The, Baltimore, Md.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Garrett, Ind.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
Mason Can Co., East Providence, R. I.
McCaskie, Inc., William, Westport, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Nilson, A. H. Machine Co., Bridgeport, Conn.
North Anson Reel Co., No. Anson, Me.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Co., Garrett, Ind.
McCaskie, Inc., William, Westport, Mass.
Muncy Valley Industries, Inc., Muncy Valley, Pa.
Nelson Company, The, Baltimore, Md.
North Anson Reel Co., No. Anson, Me.
Strand-Buffalo Corporation, North Tonawanda, N. Y.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Crucible Steel Co. of America, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Chase Brass & Copper Co., Waterbury, Conn.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Platt Bros. & Co., The, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Titan Metal Manufacturing Co., Bellefonte, Pa.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—Rust Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Company, East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TESTERS — INSULATION
(See MACHINERY—Spark Testers)

TESTING EQUIPMENT
(See MACHINERY Testing, Physical and Diameter Testing)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL—Electric Conductor)

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.
Wire Equipment Mfg. Co., Trenton, N. J.

TOOLS—Wire Cutting
Porter, H. K. Inc., Somerville, Mass.

TOOLS—Spring Forming, Carbide
Crafts, Arthur A., Company, Inc., Boston, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Adjustable Speed Drives)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

VARNISHES & LACQUERS—for Electric Wire
Chemical Products Co., E. Providence, R. I.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Litzler, C. A., Co., Inc., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machinery Inc., Northboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Alabama Wire Company, Florence, Ala.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Malin & Co., The, Cleveland, Ohio
National Standard Company, Niles, Mich.
Scovill Mfg. Co., Waterbury, Conn.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brass and Bronze
Chase Brass & Copper Co., Waterbury, Conn.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Jury's Wire Products, Inc., Bloomfield, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Bunched & Stranded, Copper
Camden Wire Co., Camden, N. Y.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Camden Wire Co., Camden, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Camden Wire Co., Inc., Camden, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Jury's Wire Products, Inc., Bloomfield, N. J.
United Wire & Supply Corporation, Providence, R. I.

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Flat, Fine
Montgomery Co., The, Windsor Locks, Conn.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
National Standard Company, Niles, Mich.
Roebling's, John A. Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Manufacturers
Alabama Wire Company, Florence, Ala.
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Keystone Steel & Wire Co., Peoria, Ill.
National Lock Washer Company, The, Newark, N. J.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Scovill Mfg. Co., Waterbury, Conn.
Sheffield Steel Corp., Kansas City, Mo.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.
U. S. Steel Corp., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio

WIRE—Needle
Carpenter Steel Company, Webb Wire Division, New Brunswick, N. J.

WIRE—Nickel Alloy
Carpenter Steel Company, Webb Wire Division, New Brunswick, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Malin & Co., The, Cleveland, Ohio
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.

WIRE—Oil Tempered
Crucible Steel Co. of America, Pittsburgh, Pa.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J.
Sheffield Steel Corp., Kansas City, Mo.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Pointed
Main, Robert A. & Sons, Inc., Paramus, N.J.

WIRE—Silver Plated Copper
Camden Wire Co., Camden, N. Y.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.

WIRE—Special Shapes
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
National Lock Washer Company, The, Newark, N. J.
Titan Metal Manufacturing Co., Bellefonte, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N. J
Sheffield Steel Corp., Kansas City, Mo.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Carpenter Steel Company, Webb Wire Division, New Brunswick, N. J.
Crucible Steel Co. of America, Pittsburgh, Pa.
Firth Sterling, Inc., Pittsburgh, Pa.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
National Lock Washer Company, The, Newark, N. J.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Steel—Also Coppered and Galvanized Steel
Alloy Metal Wire Div., H. K. Porter Company, Inc., Prospect Park, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, Pittsburgh, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jury's Wire Products, Inc., Bloomfield, N. J.
Keystone Steel & Wire Co., Peoria, Ill.
National Standard Company, Niles, Mich.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Corp., Trenton, N J.
Sheffield Steel Corp., Kansas City, Mo.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Pacific Coast Division, Oakland, Calif.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
United Wire & Supply Corporation, Providence, R. I.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Tinned Copper
Camden Wire Co., Camden, N. Y.
International Wire Products Corporation, Woodside Machinery Division, Midland Park, N. J.
Jury's Wire Products, Inc., Bloomfield, N. J.

WIRE—Weaving
Alabama Wire Company, Florence, Ala.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WOOD—for Guide, Rolls, Bushings, Wear Parts, etc.

WRAPPING PAPER—Creped
(See PAPER—Creped Wrapping)

YARNS & TAPES—Insulating
Celanese Corporation of America, New York, N. Y.
Pittsburgh Plate Glass Company, Pittsburgh, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

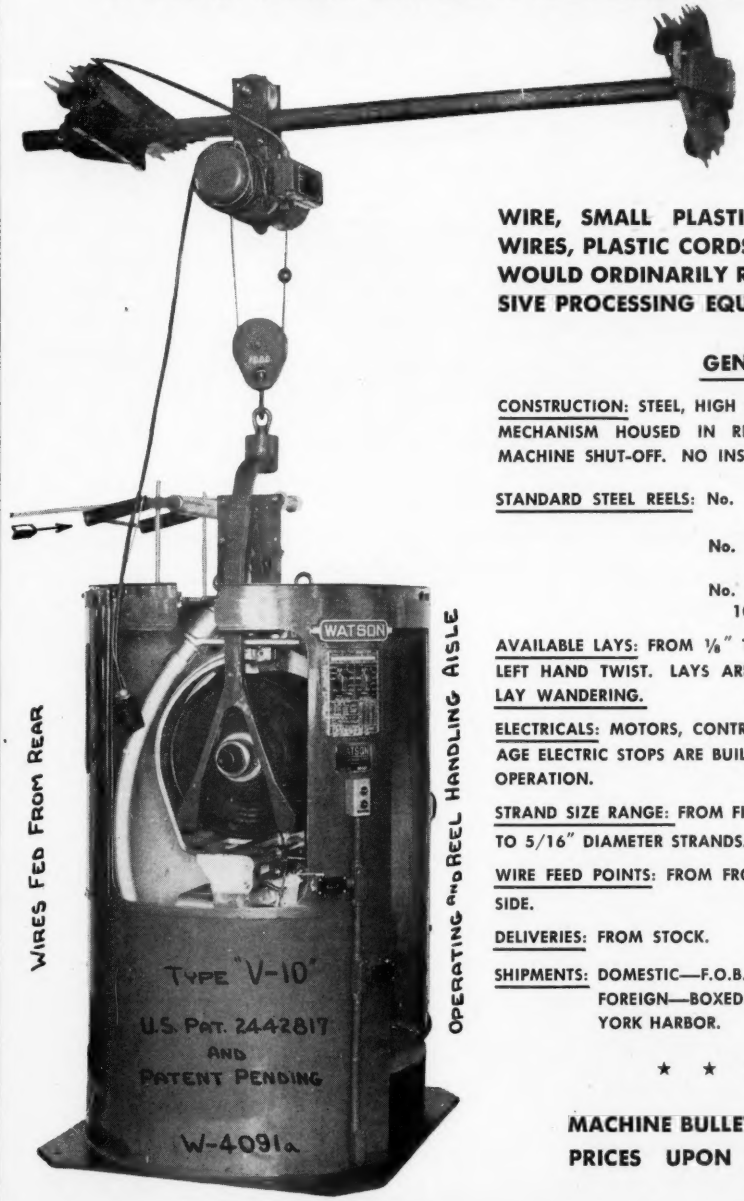
WATSON

VERTICAL BUNCHERS TYPE "V"

THE LEADING DESIGNS WITH AN INTERNATIONAL REPUTATION

NOTABLE ADVANTAGES:

1.—HIGHEST LONG-RUN OUTPUT ON LARGE STANDARD WIRE REELS.
2.—GREATEST COMPACTNESS. IDEAL FOR ROW GROUPING IN LIMITED SPACE.
3.—LABOR-SAVING. ONE OPERATOR CAN SERVE MANY MACHINES.
4.—QUICKEST PARTS SERVICE FROM CATALOGUED STOCK.
5.—LOWEST MACHINE COST DUE TO MASS MANUFACTURE.



SUITABLE FOR ALL COMMON BUNCHING WORK, AND USED ALSO FOR BUNCH-STRANDING AND CABLING OF STEEL AND ALUMINUM CLOTHESLINE, TELEVISION GUY WIRE, SEALING STRANDS, METAL FISH LINES, PAPER CORD, CONTINUOUS TWISTS OF FLAT WIRE, SMALL PLASTIC INSULATED CABLES, ANNUNCIATOR WIRES, PLASTIC CORDS, AND MANY OTHER PRODUCTS WHICH WOULD ORDINARILY REQUIRE THE USE OF MUCH MORE EXPENSIVE PROCESSING EQUIPMENT.

GENERAL SPECIFICATIONS

CONSTRUCTION: STEEL, HIGH STRENGTH ALLOYS AND BALL BEARING THROUGHOUT. MECHANISM HOUSED IN RIGID STEEL FRAME WITH SAFETY DOOR OPENING MACHINE SHUT-OFF. NO INSTALLATION WORK REQUIRED.

STANDARD STEEL REELS: No. 7—16" x 8", 250 LB. CU. CAPACITY
No. 9—22" x 11", 650 LB. CU. CAPACITY
No. 10—24" x 14", 1000 LB. CU. CAPACITY

AVAILABLE LAYS: FROM 1/8" TO 4 7/8". RIGHT AND LEFT HAND TWIST. LAYS ARE FIXED AS SET. NO LAY WANDERING.

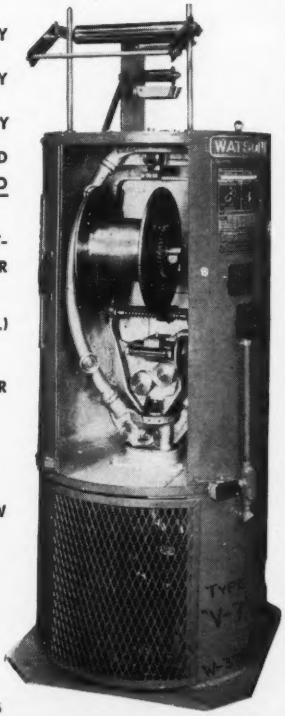
ELECTRICALS: MOTORS, CONTROLS AND LOW VOLTAGE ELECTRIC STOPS ARE BUILT IN AND WIRED FOR OPERATION.

STRAND SIZE RANGE: FROM FINE (7 x #30 B. & S.) TO 5/16" DIAMETER STRANDS.

WIRE FEED POINTS: FROM FRONT, REAR OR EITHER SIDE.

DELIVERIES: FROM STOCK.

SHIPMENTS: DOMESTIC—F.O.B. PATERSON, N. J.
FOREIGN—BOXED & DELIVERED TO NEW YORK HARBOR.



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MACHINE BULLETINS AND PRICES UPON REQUEST

6-56

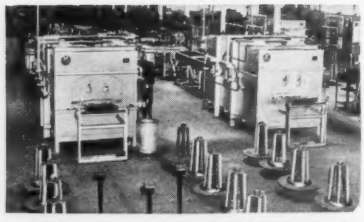
if you perform any of *these operations*

- Aging
- Annealing
- Aluminum Brazing
- Aluminizing Strip, etc.
- Billet Heating
- Brass Brazing
- Bright Annealing
- Bright Hardening
- Carbon Restoration
- Carbonitriding
- Carburizing, Gas, etc.
- Controlled Atmosphere
- Copper Brazing
- Enameling • Forging
- Galvanizing Strip, etc.
- Glass Heat Treating
- Hardening and Drawing
- Homogenizing
- Malleablizing
- Nitriding
- Normalizing
- Scale-Free Hardening
- Sintering
- Silver Soldering
- Special Atmosphere Treatments
- Spheroidizing
- Solution Heat Treating
- Strip Coating—Any Process
- Stress Relieving
- Quenching

there's an EF PRODUCTION HEAT TREATING FURNACE *to fit your specific requirements*

Backed by over 40 years of practical furnace building experience and thousands of successful fuel fired and electric furnace installations, EF engineers are in position to design and build just the size and type of equipment you need for handling any product or production, or for any heat treating or processing requirement.

Submit your production furnace problems to experienced EF engineers — it pays.



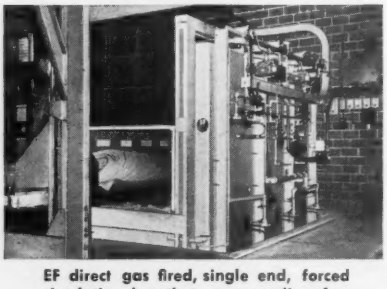
Stainless steel wire is bright annealed continuously in these EF multiple tube furnaces.

THE ELECTRIC FURNACE CO.

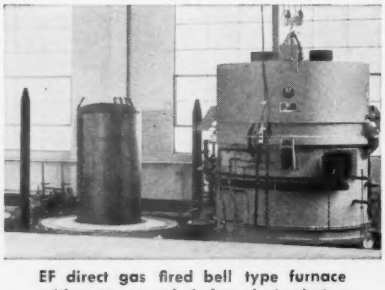
GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

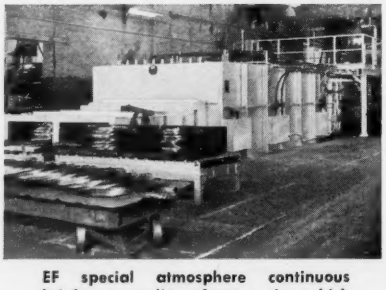
Canadian Associates • Canefco Limited • Toronto 1, Canada



EF direct gas fired, single end, forced circulation hearth type annealing furnace with gantry crane for handling large coils of cupro nickel wire and brass rod.



EF direct gas fired bell type furnace with retorts and 4 forced circulation bases, used for bright annealing both ferrous and non-ferrous flat coiled wire.



EF special atmosphere continuous bright annealing furnace in which the wire is conveyed through the various zones on two parallel rows of bulkhead type trays.